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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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INTRODUCTION

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The authority for the indexing vocabulary used in the subject index of this issue of *STAR* is the *NASA Thesaurus*. The most recent version is the *NASA Thesaurus—Alphabetical Update* (NASA SP-7040), September 1971, which is available from NTIS as accession number N72-15923 for $6.00 in paper copy. The current cross-reference structuring for each term appears in this volume, together with additional approved terms that may be used in indexing documents announced in other issues of *STAR*. NASA SP-7040 supersedes the first two volumes (subject terms A–Z) of the three-volume *Preliminary Edition of the NASA Thesaurus* (NASA SP-7030), December 1967. Volume III of the Preliminary Edition presented the following aids to vocabulary selection of the 1967 terms: hierarchical display of index terms, category terms listing, and permuted index; this has not been updated but may still be useful.

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Volume 11 Number 18 / September 23, 1973

TABLE OF CONTENTS

Subject Categories

Abstracts in the journal are grouped under the following categories:

page

01 Aerodynamics 2101
Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 32 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

02 Aircraft 2102
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc.; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

03 Auxiliary Systems 2108
Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

04 Biosciences 2109
Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

05 Biotechnology 2110
Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

06 Chemistry 2113
Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

07 Communications 2115
Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

08 Computers 2121
Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

09 Electronic Equipment 2122
Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors, integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

10 Electronics 2125
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

11 Facilities, Research and Support 2125
Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

12 Fluid Mechanics 2128
Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

13 Geophysics 2132
Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

14 Instrumentation and Photography 2150
Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders, transducers; aerial photography; and telescopes and cameras.

15 Machine Elements and Processes 2154
Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

16 Masers 2157
Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

17 Materials, Metallic 2159
Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

page

18 Materials, Nonmetallic 2163
Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

19 Mathematics 2169
Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

20 Meteorology 2170
Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

21 Navigation 2175
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

22 Nuclear Engineering 2176
Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

23 Physics, General 2178
Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology, and 29 Space Radiation.

24 Physics, Atomic, Molecular, and Nuclear 2180
Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

25 Physics, Plasma 2182
Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

26 Physics, Solid-State 2184
Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

27 Propellants 2192
Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

28 Propulsion Systems 2192
Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

29 Space Radiation 2194
Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

30 Space Sciences 2196
Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbits and trajectories. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

31 Space Vehicles 2199
Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

32 Structural Mechanics 2202
Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

33 Thermodynamics and Combustion 2205
Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

34 General 2207
Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

page

SUBJECT INDEX I-1
PERSONAL AUTHOR INDEX I-45
CORPORATE SOURCE INDEX I-51
CONTRACT NUMBER INDEX I-63
REPORT/ACCESSION NUMBER INDEX I-67

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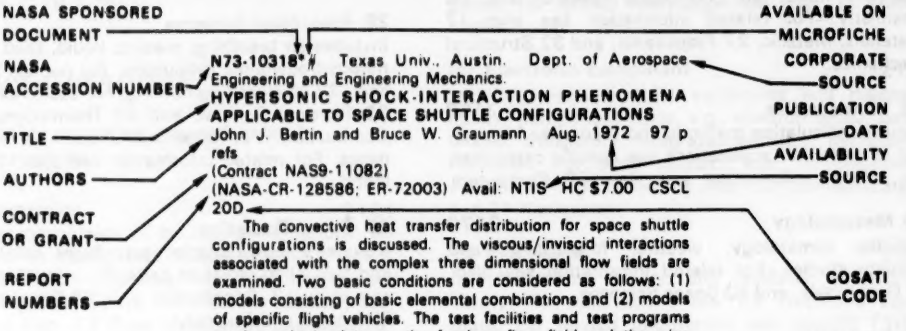
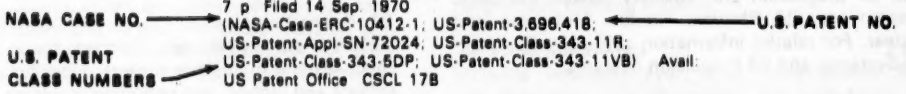


N73-10318*# Texas Univ., Austin. Dept. of Aerospace Engineering and Engineering Mechanics.
HYPERSONIC SHOCK-INTERACTION PHENOMENA APPLICABLE TO SPACE SHUTTLE CONFIGURATIONS
John J. Bertin and Bruce W. Graumann. Aug. 1972 97 p refs
(Contract NAS9-11082)
(NASA-CR-128586; ER-72003) Avail: NTIS HC $7.00 CSCL 20D

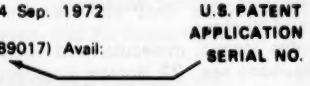
The convective heat transfer distribution for space shuttle configurations is discussed. The viscous/inviscid interactions associated with the complex three dimensional flow fields are examined. Two basic conditions are considered as follows: (1) models consisting of basic elemental combinations and (2) models of specific flight vehicles. The test facilities and test programs used to obtain data on the fuselage flow field and the wing flow field are described. Author

PATENT CITATION



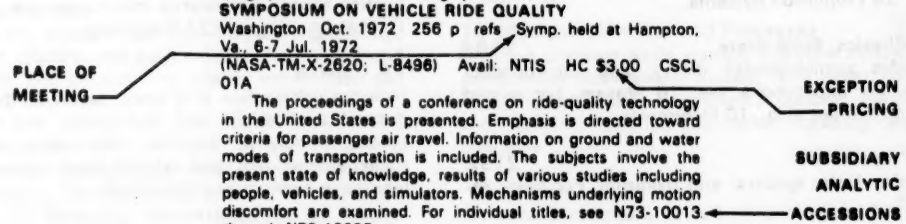
N73-12211* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
ALTITUDE MEASURING SYSTEM Patent
George B. Litchford, inventor (to NASA) Issued 3 Oct. 1972 7 p Filed 14 Sep. 1970
(NASA-Case-ERC-10412-1; US-Patent-3,696,418; US-Patent-Appl-SN-72024; US-Patent-Class-343-11R; US-Patent-Class-343-5DP; US-Patent-Class-343-11VB) Avail: US Patent Office CSCL 17B

PATENT APPLICATION CITATION



N73-10504*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GRINDING ARRANGEMENT FOR BALL NOSE MILLING CUTTERS Patent Application
Charles F. Burch, inventor (to NASA) Filed 14 Sep. 1972 19 p
(NASA-Case-LAR-10450-1; US-Patent-Appl-SN-289017) Avail: NTIS HC $3.00 CSCL 13I

PRIMARY ANALYTIC CITATION AND ABSTRACT



N73-10012*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SYMPOSIUM ON VEHICLE RIDE QUALITY
Washington Oct. 1972 256 p refs Symp. held at Hampton, Va., 6-7 Jul. 1972
(NASA-TM-X-2620; L-8496) Avail: NTIS HC $3.00 CSCL 01A

The proceedings of a conference on ride-quality technology in the United States is presented. Emphasis is directed toward criteria for passenger air travel. Information on ground and water modes of transportation is included. The subjects involve the present state of knowledge, results of various studies including people, vehicles, and simulators. Mechanisms underlying motion discomfort are examined. For individual titles, see N73-10013 through N73-10025.

SUBSIDIARY ANALYTIC CITATION

N73-10014* Douglas Aircraft Co., Inc., Long Beach, Calif.
AN AIRCRAFT MANUFACTURER'S APPROACH TO RIDEABILITY CRITERIA
R. C. OMassey, H. Leve, and J. G. Gaume *In* NASA. Langley Res. Center Symp. on Vehicle Ride Quality Oct. 1972 p 23-49 refs (For availability see N73-10012 01-02)
CSCL 01A

VOLUME 11 NUMBER 18 / SEPTEMBER 23, 1973

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N73-26990* + National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBILIOGRAPHY, SUPPLEMENT 30, APRIL 1973
Apr. 1973 125 p refs
(NASA-SP-7037(30)) Avail: NTIS HC $3.00 CSCL 01A

This special bibliography lists 423 reports, articles, and other documents introduced into the NASA scientific and technical information system in March 1973. Author

N73-26991* + National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY, SUPPLEMENT 31, MAY 1973
May 1973 96 p refs
(NASA-SP-7037(31)) Avail: NTIS HC $3.00 CSCL 01A

This special bibliography lists 307 reports, articles, and other documents introduced into the NASA scientific and technical information system in April 1973.

N73-26992*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GEOMETRIC FACTORS AFFECTING NOISE SUPPRESION AND THRUST LOSS OF DIVERGENT-LOBE SUPERSONIC JET NOISE SUPPRESSOR
Ronald G. Huff and Donald E. Groesbeck Washington Jul. 1973 25 p refs
(NASA-TM-X-2820; E-7393) Avail: NTIS HC $3.00 CSCL 20A

The thrust loss and noise suppression of a divergent-lobe supersonic jet noise suppressor were experimentally determined over a range of nozzle pressure ratios of 1.5 to 4.0. These small-scale cold flow tests were made to determine the effect on thrust and noise of: suppressor length, rearward facing step height, suppressor divergence angle, and ejector shroud length and location. Noise suppression was achieved at nozzle pressure ratios of 2.5 and greater. Maximum lobe jet noise attenuation of 15 db with thrust loss differences of 1.5 percent compared to the convergent nozzle were obtained at a nozzle pressure ratio of 3.5 with an ejector shroud two nozzle diameters long. Without the ejector the attenuation was 13 db with thrust loss differences of 11 percent. Short suppressors approximately one primary nozzle throat diameter long performed as well as longer suppressors. Rearward facing step height had a significant effect on noise suppression. Ejector shrouds two nozzle diameters in length are feasible. Author

N73-26993*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUPERSONIC AERODYNAMIC CHARACTERISTICS OF HYPERSONIC LOW-WAVE-DRAG ELLIPTICAL BODY-TAIL COMBINATIONS AS AFFECTED BY CHANGES IN STABILIZER CONFIGURATION
Bernard Spencer, Jr. and Roger H. Fournier Washington Jul. 1973 95 p refs
(NASA-TM-X-2747; L-8640) Avail: NTIS HC $3.00 CSCL 01A

An investigation has been made at Mach numbers from 1.50 to 4.63 to determine systematically the effects of the addition and position of outboard stabilizers and vertical- and vee-tail configurations on the performance and stability characteristics of a low-wave-drag elliptical body. The basic body shape was a zero-lift hypersonic minimum-wave-drag body as determined for the geometric constraints of length and volume. The elliptical cross section had an axis ratio of 2 (major axis horizontal) and an equivalent fineness ratio of 6.14. Base-mounted outboard stabilizers were at various dihedral angles from 90 deg to minus 90 deg with and without a single center-line vertical tail or a vee-tail. The angle of attack was varied from about minus 6 to 27 deg at sideslip angles of 0 and 5 deg and a constant Reynolds number of 4.58 x one million (based on body length). Author

N73-26994# National Aerospace Lab., Tokyo (Japan).
ON THE DRAG DIVERGENCE OF TWO-DIMENSIONAL AIRFOILS AT TRANSONIC SPEEDS
Nobuhiko Kamiya Jan. 1973 112 p refs In JAPANESE, ENGLISH summary
(NAL-TR-299) Avail: NTIS HC $7.75

An experimental and theoretical investigation of the drag-divergence on two-dimensional airfoils was conducted. The data were used to design an airfoil for economical cruise at high subsonic speeds. The pressure distributions on optimum airfoils are discussed. A predominant parameter which determines the drag-divergence characteristics improve as the thickness near the leading edge decreases. A method is proposed for developing airfoils with appropriate drag-divergence characteristics. Author

N73-26995*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF FIN PLANFORM ON THE AERODYNAMIC CHARACTERISTICS OF A WINGLESS MISSILE WITH AFT CRUCIFORM CONTROLS AT MACH 1.60, 2.36, AND 2.86
Charles D. Trescot, Jr., Gerald V. Foster, and C. Donald Babb Washington Jul. 1973 101 p ref
(NASA-TM-X-2774; L-8783) Avail: NTIS HC $3.00 CSCL 01A

An investigation was made in the Langley Unitary Plan wind tunnel to determine the effects of fin planform on the static longitudinal aerodynamic characteristics of a wingless maneuvering missile configuration having cruciform, all-movable, aft control surfaces. The tests were made at Mach numbers of 1.60, 2.36, and 2.86 through an angle of attack range from about -4 to 22 deg, at an angle of sideslip of 0 deg, and at a Reynolds number of 8.2 million based on model length. The pitch-control

data were obtained at model roll angles of 0 and 45 deg. Control-surface forces and moments were also measured. Four alternate fin planforms were investigated. Author

N73-26996*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FORTRAN PROGRAM FOR CALCULATING VELOCITIES AND STREAMLINES ON THE HUB-SHROUD MID-CHANNEL FLOW SURFACE OF AN AXIAL- OR MIXED-FLOW TURBOMACHINE. 1: USER'S MANUAL
Theodore Katsanis Washington Jul. 1973 97 p refs
(NASA-TN-D-7343; E-7154) Avail: NTIS HC $3.00 CSCL 20D

A FORTRAN 4 computer program has been developed that obtains a subsonic or shock-free transonic flow solution on the hub-shroud mid-channel flow surface of a turbomachine. The blade row may be fixed or rotating, and may be twisted and leaned. Flow may be axial or mixed, up to 45 deg from axial. Upstream and downstream flow variables may vary from hub to shroud, and provision is made to correct for loss of stagnation pressure. The results include velocities, streamlines, and flow angles on the flow surface; and approximate blade surface velocities. Subsonic solutions are obtained by a finite-difference stream-function solution. Transonic solutions are obtained by a velocity-gradient method, using information from a finite-difference stream-function solution at a reduced mass flow. Author

N73-26997*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC AND FLOW-VISUALIZATION STUDIES OF TWO DELTA-WING ENTRY VEHICLES AT A MACH NUMBER OF 20.3
James P. Arrington and David R. Stone Washington Aug. 1973 72 p refs Technical Film Supplement L-1137 available on request to: NASA. Langley Research Center, Hampton, Va. 23665 Attn: Photographic Branch, Mail Stop 171
(NASA-TN-D-7282; L-8892) Avail: NTIS HC $3.00 CSCL 01A

The longitudinal, lateral, and directional aerodynamic characteristics of two space shuttle concepts have been obtained in helium for operational flight Reynolds numbers at angles of attack from minus 10 to 55 deg. Included are elevon control deflections, roll control due to ailerons, and the effects of a nose modification. Selected results were compared with those derived from tangent-cone and Newtonian theories. Also included are results of a flow-visualization study consisting of electron-beam-illuminated flow and surface oil-flow patterns. Author

N73-26998# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
ASYMMETRIC NOSE BLUNTNESS EFFECT ON THE AERODYNAMICS OF A SLENDER CONE AT MACH 14
Otto Walchner Apr. 1973 32 p refs Presented at AIAA Atmos. Flight Mech. Conf., 2d, Palo Alto, Calif., 11-13 Sep. 1972
(AF Proj. 7064)
(AD-760807; ARL-73-0072) Avail: NTIS CSCL 16/3

Experiments were performed in ARL's 20-inch hypersonic wind tunnel on a 10 degree half-angle circular cone model whose pointed tip was removed by one or more planar slanted cuts. The projected frontal nose area was 1/2 percent of the base area. The configurational asymmetry of this moderate bluntness destroys the rotational symmetry of the shock wave over the entire model. In turn, the rotational symmetry of the surface pressure distribution is also lost. Depending on the nose configuration, asymmetric sideloads were observed at axial flow conditions which may or may not cause the vehicle to trim in free flight. Nose asymmetry combined with mass asymmetry, therefore, may produce a rolling moment even at zero trim. The stability derivatives are not identical in pitch and yaw, as would be expected for a body of revolution, and vary differently as functions of the angle of attack and angle of sideslip. (Author Modified Abstract) GRA

N73-26999# Naval Ordnance Lab., White Oak, Md.
STATIC AND DYNAMIC STABILITY OF FREE-FALL STORES WITH FREELY SPINNING STABILIZERS
Frank J. Regan 17 Jan. 1973 101 p refs
(AD-760677; NOLTR-73-19) Avail: NTIS CSCL 19/1

The report is the second in a two-part series of technical reports on the dynamics and aerodynamics of free-fall stores using freely spinning stabilizers. The first report presented aerodynamic data on representative free-fall store. This second report examines the dynamics of freely spinning configurations with 180-degree rotational and mirror symmetries. Specifically, it demonstrates how spin rate, restoring moment, damping moment and mass distribution are interrelated to maintain static and dynamic stability. The effect of stabilizer and forebody asymmetries on the magnitude of the rolling trim arm is also considered. Stability diagrams are developed which present these results graphically. Author (GRA)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N73-27000# Advisory Group for Aerospace Research and Development, Paris (France).
MILITARY APPLICATIONS OF V/STOL AIRCRAFT, VOLUME 1
Apr. 1973 145 p refs Partly in ENGLISH and partly in FRENCH Presented at 41st meeting of the flight Mech. Panel of AGARD, Brussels, 23-25 Oct. 1972
(AGARD-CP-126-Vol-1) Avail: NTIS HC $9.25

The proceedings of a conference on the military applications of V/STOL aircraft are presented. Past developments on experimental V/STOL aircraft as well as current military doctrine and operational experience are discussed. Ongoing and new development programs are reviewed to provide visibility to potential new capabilities. Future military applications for V/STOL aircraft in terms of currently perceived operational requirements were analyzed. For individual titles, see N73-27001 through N73-27013.

N73-27001 Massachusetts Inst. of Tech., Cambridge.
A REVIEW OF PAST AGARD/NATO ACTIONS ON V/STOL AIRCRAFT AND THEIR APPLICATIONS
R. H. Miller *In* AGARD Mil. Appl. of V/STOL Aircraft, Vol. 1 Apr. 1973 3 p (For availability see N73-27000 18-02)

The 1969 meeting was convened in order to review the results of an AGARD study, V/STOL Comparison Study, conducted by an ad hoc group of specialists in late 1968 and 1969 and published as AGARD Advisory Report No. 18. This study reviewed the status of existing technology, giving details of the many VTOL vehicles which had been built and the lessons learned from their flight experiences. The report then reviewed the manner in which further research could be expected to increase the effectiveness of such vehicles and the potential mission improvements which would result. The missions considered were attack, transport and rescue. Finally a research program was outlined which hopefully would ensure achieving these improvements. Author

N73-27002 Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
WIND TUNNEL FOCUSING POINT STUDY AND FLIGHT TEST OF ASSULT MIRAGE 3 5 [ETUDE ET MISE AU POINT EN SOUFFLERIE ET EN VOL DE L'AVION DASSAULT MIRAGE 3 5]
G. DeRichemont *In* AGARD Mil. Appl. of V/STOL Aircraft, Vol. 1 Apr. 1973 15 p In FRENCH (For availability see N73-27000 18-02)

Flight transition and control problems of the Mirage 3 (5) attack aircraft are studied during flight and in wind tunnels. Data cover flight variations caused by exhaust, longitudinal skidding effects, and lift. A comparison was made of test results. Transl. by E.H.W.

N73-27003 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Prototype Div.
A REVIEW OF THE US TRI-SERVICE V/STOL PROGRAMS
Bernard Lindenbaum and Daniel E. Fraga *In* AGARD Mil. Appl. of V/STOL Aircraft, Vol. 1 Apr. 1973 17 p refs (For availability see N73-27000 18-02)

A brief history of the U.S. Tri-Service V/STOL Programs is presented and aspects of propeller-based propulsion systems for VTOL aircraft as represented by the three distinctly different design concepts found in the XC-142A, X-19 and X-22A are examined. A comparison of the basic characteristics of these aircraft is provided in hover and vertical flight, transition and STOL flight and flight in the conventional mode. This includes a discussion of vehicle performance and efficiencies, handling qualities, and method of flight control. In addition a summary of the major accidents associated with these programs is presented as well as a brief discussion of the impact of technology improvements on future propeller driven VTOL designs. Author

N73-27004 Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
DO 31 EXPERIMENTAL PROGRAM: RESULTS AND CONCLUSIONS OBTAINED AND FUTURE OUTLOOK [PROGRAMME EXPERIMENTAL DO 31: RESULTATS OBTENUS ET CONCLUSIONS A TIRER POUR L'AVENIR]
Radoslav Draganow and Heinz Max *In* AGARD Mil. Appl. of V/STOL Aircraft, Vol. 1 Apr. 1973 15 p refs In FRENCH (For availability see N73-27000 18-02)

The technical aspects of the Dornier 31 V/STOL aircraft and the research project leading to production of the aircraft are discussed. The following problems of V/STOL aircraft operation are discussed: (1) control of the engine system, (2) stability and control in hover and transition, (3) jet interference effects, (4) recirculation and ground erosion effects, and (5) noise problems. Author

N73-27005 Marine Aircraft Wing (2d), Cherry Point, N.C.
AV-8A HARRIER CONCEPT AND OPERATIONAL PERFORMANCE, US MARINE CORPS
T. H. Miller, Jr. and C. M. Baker (Marine Aircraft Group 32, Beaufort, S. C.) *In* AGARD Mil. Appl. of V/STOL Aircraft, Vol. 1 Apr. 1973 6 p (For availability see N73-27000 18-02)

The design concept and operational performance of the AV-8a Harrier aircraft are discussed. An analysis of the U.S. Marine Corps requirements and employment of the aircraft for military purposes is presented. The use of V/STOL aircraft in various military situations is reported. Author

N73-27006 Vereinigte Flugtechnische Werke G.m.b.H., Bremen (West Germany).
VAK 191 B EXPERIMENTAL PROGRAM FOR A V/STOL STRIKE-RECCE AIRCRAFT
Rolf Ricciús and Werner Sobotta *In* AGARD Mil. Appl. of V/STOL Aircraft, Vol. 1 Apr. 1973 18 p refs (For availability see N73-27000 18-02)

The design, development, and flight characteristics of the VAK 191b strike/reconnaissance aircraft are presented. The subjects discussed are: (1) research and development test program, (2) control systems, (3) longitudinal response, (4) hovering and vertical flight path characteristics, (5) flight control system transition characteristics, and (6) growth potential. Author

N73-27007 Canadair, Ltd., Montreal (Quebec).
TESTING AND EVALUATION OF THE CANADAIR CL-84 TILT WING V/STOL AIRCRAFT
F. C. Phillips *In* AGARD Mil. Appl. of V/STOL Aircraft, Vol. 1 Apr. 1973 13 p refs (For availability see N73-27000 18-02) Avail: NTIS

The testing and evaluation of the CL-84 tilt-wing V/STOL aircraft are discussed. The subjects presented are: (1) the CL-84 prototype program, (2) evaluation program, (3) operational experience, (4) application to specific military roles, and (5) instrument flying evaluation. Author

N73-27008 Avions Marcel Dassault, Saint-Cloud (France).
EXPERIENCE ACQUIRED DURING THE COURSE OF FLIGHT TESTS AND OPERATIONAL UTILIZATION OF BREGUET 941 STOL AIRCRAFT [EXPERIENCE ACQUISE AU COURS DES ESSAIS EN VOL ET EN UTILISATION OPERATIONNELLE DE L'AVIONS STOL BREGUET 941]
J. Czinczenheim *In* AGARD Mil. Appl. of V/STOL Aircraft, Vol. 1 Apr. 1973 12 p refs In FRENCH (For availability see N73-27000 18-02)

The history and performance principles of the Berguet 941 STOL aircraft are presented. Problems encountered during the course of flight tests and solutions adopted are given. Test data cover handling qualities, operational characteristics, rolling stability on the ground, and flight qualities. Transl. by E.H.W.

N73-27009* National Aeronautics and Space Administration, Washington, D.C.
NASA PROPULSIVE LIFT STOL TECHNOLOGY PROGRAM
Gerald G. Kayten and William S. Aiken *In* AGARD Mil. Appl. of V/STOL Aircraft, Vol. 1 Apr. 1973 4 p (For availability see N73-27000 18-02)
CSCL 01C

A NASA propulsive-lift technology program for short takeoff aircraft is discussed. In the propulsive-lift program, turbofan engine power is used to augment the lift of essentially conventional wings. Potentially important applications of the propulsive lift developments for various aircraft operating conditions are reported. It is stated that the objective of the program is to provide technical information on the design, development, operation, and regulation of propulsive-lift aircraft. Author

N73-27010* De Havilland Aircraft Co., Ltd., Downsview (Ontario).
THE BUFFALO/SPEY JET-STOL RESEARCH AIRCRAFT
D. C. Whittley *In* AGARD Mil. Appl. of V/STOL Aircraft, Vol. 1 Apr. 1973 13 p refs Sponsored in part by NASA (For availability see N73-27000 18-02)
CSCL 01C

The program to design and build a Buffalo/Spey Augmentor-Wing research aircraft is presented. The development of an internally blown flap system for the generation of powered lift is discussed. Modification, development, and testing of the Rolls-Royce Spey engine are reported. The ground tests and first flights of the aircraft are described and the application of the internally blown flap concept for short takeoff military transport aircraft is proposed. Author

N73-27011 British Aircraft Corp., Weybridge (England).
MILITARY ASPECTS OF CIVIL V/STOL AIRCRAFT
N. W. Boorer *In* AGARD Mil. Appl. of V/STOL Aircraft, Vol. 1 Apr. 1973 12 p ref (For availability see N73-27000 18-02)

The rationale of developing a military tactical short takeoff transport aircraft in an evolutionary pattern in parallel with the development of civil short takeoff aircraft is presented. The main characteristics of military and civil short takeoff aircraft are described. The military requirements and operational considerations of the short takeoff transport aircraft are defined. Author

N73-27012 Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
SELECTING A STOL TRANSPORT
Fred D. Orazio, Sr. *In* AGARD Mil. Appl. of V/STOL Aircraft, Vol. 1 Apr. 1973 9 p refs (For availability see N73-27000 18-02)

The procedures for identifying the proper characteristics of a short takeoff transport aircraft using current and past development efforts are discussed. The procedures include: (1) feasible designs incorporating powered/lift systems, (2) advanced systems (including composite structures), (3) high flotation landing gears, (4) vulnerability protection, (5) operating margins and criteria, (6) aircraft handling qualities, (7) operating constraints, and (8) costs. Author

N73-27013 Bundesminister fuer Verteidigung, Bonn (West Germany).
GERMAN COMMENTS ON FUTURE V/STOL REQUIREMENTS
Uwe Koester *In* AGARD Mil. Appl. of V/STOL Aircraft, Vol. 1 Apr. 1973 2 p (For availability see N73-27000 18-02)

A survey of the V/STOL weapon system developments in Germany or with German participation is presented. The rationale

for developing short takeoff rather than vertical takeoff aircraft is developed. Problems involved in the engineering of short takeoff aircraft are described. The reasons for not formulating concrete military requirements for short takeoff aircraft are enumerated.
Author

N73-27014# Utah Univ., Salt Lake City.
PHYSIO-CHEMICAL STUDY OF SMOKE EMISSION BY AIRCRAFT INTERIOR MATERIALS. PART 1: PHYSIOLOGICAL AND TOXICOLOGICAL ASPECTS OF SMOKE DURING FIRE EXPOSURE Final Report, Oct. 1969 - Jun. 1973
I. N. Einhorn Jul. 1973 86 p refs Sponsored by FAA
(FAA-RD-73-50-Pt-1; FAA-NA-73-70-Pt-1) Avail: NTIS HC $6.50

A concise review of the physiological and toxicological aspects of smoke during fire exposure has been presented. The parameters, both chemical and physical, which lead to smoke development, and subsequently, light obscuration, during their pyrolysis and combustion are discussed. Various laboratory test procedures, both small-scale and large-scale, have been summarized and a critique presented outlining their usefulness and problems encountered in interpretation of results obtained using these test procedures. A review of the physiological and toxicological parameters affecting survival of humans during fire exposure is given. Consideration is directed toward the specific hazards encountered during aircraft accidents involving fire. Recent reviews of the medical literature pertaining to fire injury is discussed in detail.
Author

N73-27015# Civil Aeromedical Inst., Oklahoma City, Okla.
FREQUENCY OF ANTI-COLLISION OBSERVING RESPONSES BY SOLO PILOTS AS A FUNCTION OF TRAFFIC DENSITY, ATC TRAFFIC WARNINGS, AND COMPETING BEHAVIOR
Mark F. Lewis Apr. 1973 6 p refs
(FAA-AM-73-6) Avail: NTIS HC $3.00

Instrument-rated pilots were flown in two-hour simulated solo missions during which the frequency of traffic, ATC warnings, and ATC clearances were varied, while the visibility of the target was held constant at 100%. Each pilot was advised that his IFR mission occurred under VFR conditions and that it was his primary responsibility to maintain visual vigilance, although ATC would endeavor to warn him of possible conflicting traffic. Two values of traffic frequency were programmed independently of two values of ATC traffic warning frequency. The frequency of competing behavior was varied by independent scheduling of two values of ATC clearance frequency. The data revealed main effects from ATC clearances and from traffic warnings. Significant interactions were obtained for clearances by traffic warnings and for traffic by traffic warnings.
Author

N73-27016# Federal Aviation Administration, Washington, D.C. Office of Aviation Medicine.
THE AIRCRAFT AS AN INSTRUMENT OF SELF-DESTRUCTION
Robert E. Yanowitch and Jack A. Bergin Mar. 1973 7 p refs
(FAA-AM-73-5) Avail: NTIS HC $3.00

Often the relationship between the pilot and his aircraft is such that the aircraft may be thought of as an extension of the pilot himself during the act of flight. If this pilot accumulates stress in his life with which he can no longer adequately cope, he may engage in self-destructive acts, some of these within the context of his flying activities. The competent pilot practices and acquires skills which help him to deal with the stress of demanding flight situations. However, if this individual exceeds his piloting capabilities, or is already coping with a high stress level to his maximum capacity, the additional stress of a particular flight situation may overload his total coping ability and destruction of self, both psychologically and physically, will occur.
Author

N73-27017# Boeing Co., Seattle, Wash. Commercial Airplane Group.
THE 727 NOISE RETROFIT FEASIBILITY. VOLUME 2: UPPER GOAL DESIGN, FABRICATION, AND GROUND TESTING Final Report, Jul. 1971 - Nov. 1972
J. R. Anderson, H. G. Ridley, and J. W. Smith Nov. 1972 117 p refs
(Contract DOT-FA71WA-2637)
(FAA-RD-72-40-Vol-2; D6-60175) Avail: NTIS HC $8.00

The development, design, fabrication, and ground testing of a flightworthy quiet-nacelle configuration conforming to the FAA upper noise-reduction goals for the 727 airplane are discussed. The quiet-nacelle configuration tested consists of a double-ring, acoustically treated, side engine inlet; acoustically treated engine fan duct, and a multilobe, variable-geometry ejector/suppressor in the engine exhaust system. This quiet-nacelle configuration was ground tested to obtain comparative acoustic and performance data with the production-baseline nacelle. A direct operating cost (DOC) analysis was prepared based on preliminary retrofit installation cost estimates and predicted airplane performance analyses. In addition, a retrofit kit and installation package were developed to obtain realistic retrofit kit prices, installation costs, and maintenance costs to facilitate the final update of the direct operating cost analysis.
Author

N73-27018# Booz-Allen Applied Research, Inc., Bethesda, Md.
STATISTICAL PREDICTION MODEL FOR GLASS BREAKAGE FROM NOMINAL SONIC BOOM LOADS Final Report
Robert L. Hershey and Thomas H. Higgins (FAA, Washington, D. C.) 30 Jul. 1973 216 p refs
(Contract DOT-FA72WA-2823)
(FAA-RD-73-79) Avail: NTIS

A statistical model was developed which can be used to estimate the probability of glass breakage from sonic booms as a function of their nominal overpressure. Other parameters which can be taken into account in breakage probability calculations with this model include window size, aircraft vector, boom duration, and whether the glass was previously in good condition or cracked. A model window population has been devised from available data which includes the distributions of dynamic amplification factors and breaking pressures for seven window types. From computer generation of histograms from test data, the distribution of both sonic boom stresses and glass strengths were found to be lognormal. By use of the model, it was estimated that there would be 1.1 breaks per million panes in good condition boomed at a nominal overpressure of 1 psf.
Author

N73-27019# Collins Radio Co., Cedar Rapids, Iowa. Avionics Div.
CURVED APPROACH PATH STUDY Final Report
K. E. Duning, N. B. Hemesath, C. W. Hickok, D. G. Lammers, and M. L. Goemaat Apr. 1973 126 p refs
(Contract DOT-FA72WA-2824)
(FAA-RD-73-143; Rept-523-0764756-00111M) Avail: NTIS HC $8.50

The application of microwave landing systems (MLS) to provide increased operational flexibility and improved capacity in the terminal area is discussed. The performance characteristics of the various classes of aircraft which influence terminal area flight path design are identified and documented. Terminal area operational concepts and flight path families for use in the MLS environment are developed, and examples of special noise abatement paths are discussed. The implications upon cockpit equipment of flying flexible paths in the MLS environment are addressed, and the performance of current flight control systems in tracking segmented paths is examined.
Author

N73-27020*# Pratt and Whitney Aircraft, East Hartford, Conn.
STUDIES FOR DETERMINING RAPID THRUST RESPONSE REQUIREMENTS AND TECHNIQUES FOR USE IN A LONG RANGE TRANSPORT AIRCRAFT
D. M. Newirth and W. W. Ferguson Aug. 1973 65 p
(Contract NAS3-15550)
(NASA-CR-121243; PWA-4693) Avail: NTIS HC $5.25 CSCL 01C

Propulsion systems proposed for the next generation of long-range transport aircraft will utilize advanced technology to reduce the noise to levels that will be inoffensive to the community. Additional reductions can be realized by adopting steeper glide slopes during the landing approach. The aircraft dynamic characteristics and methods of obtaining rapid engine response during the go-around maneuver from an aborted landing approach are identified and discussed. The study concludes that the present levels of flight safety will not be compromised by the steeper approach.
Author

N73-27021*# Dayton Univ. Research Inst., Ohio.
A MODEL OF WIND SHEAR AND TURBULENCE IN THE SURFACE BOUNDARY LAYER
James K. Luers Washington NASA Jul. 1973 43 p refs (Contract NAS8-26600)
(NASA-CR-2288) Avail: NTIS HC $3.00 CSCL 20D

A model of wind and turbulence has been described for the surface boundary layer. The wind structure in the surface layer is considered to be a function of the surface parameters, stability, and height. The surface parameters considered are: (1) the surface roughness length; (2) the surface friction velocity; and (3) the zero plane displacement height. The stability parameter, Z/L, where L is the Monin-Obukov stability length, describes the thermal effect on the wind profile. The logarithmic wind profile is used to describe the mean wind field in the neutral boundary layer, and a logarithmic profile with a stability defect is used to describe the stable and unstable atmospheric conditions. For the very stable conditions, the logarithmic wind law does not hold. Under this condition, the layers of the atmosphere become disconnected and large scale frontal motions are the predominate factor in defining the wind profile. Figures are presented which represent some typical wind profiles in the very stable condition. Author

N73-27022*# North Carolina. State Univ., Raleigh. Dept. of Mechanical and Aerospace Engineering.
POINT AND PATH PERFORMANCE OF LIGHT AIRCRAFT: A REVIEW AND ANALYSIS
Frederick O. Smetana, Delbert C. Summey, and W. Donald Johnson Washington NASA Jun. 1973 136 p refs
(Contract NAS1-9603)
(NASA-CR-2272) Avail: NTIS HC $3.00 CSCL 01C

The literature on methods for predicting the performance of light aircraft is reviewed. The methods discussed in the review extend from the classical instantaneous maximum or minimum technique to techniques for generating mathematically optimum flight paths. Classical point performance techniques are shown to be adequate in many cases but their accuracies are compromised by the need to use simple lift, drag, and thrust relations in order to get closed form solutions. Also the investigation of the effect of changes in weight, altitude, configuration, etc. involves many essentially repetative calculations. Accordingly, computer programs are provided which can fit arbitrary drag polars and power curves with very high precision and which can then use the resulting fits to compute the performance under the assumption that the aircraft is not accelerating. Author

N73-27023*# Dayton Univ. Research Inst., Ohio.
EFFECT OF SHEAR ON AIRCRAFT LANDING Technical Report, Jul. 1971 - Nov. 1972
James K. Luers and Jerry B. Reeves Washington NASA Jul. 1973 74 p refs
(Contract NAS8-26600)
(NASA-CR-2287) Avail: NTIS HC $3.00 CSCL 01B

A simulation study was conducted to determine the effect of wind shear on aircraft landings. The landing of various type of commercial and military aircraft was digitally simulated starting from an initial altitude of 300 feet. Assuming no pilot feedback during descent, the deviation in touchdown point due to vertical profiles of wind shear was determined. The vertical profiles of wind shear are defined in terms of surface roughness, Z sub 0, and stability, L, parameters. The effects on touchdown due to Z sub 0 and L have been calculated for the different type aircraft. Comparisons were made between the following types of aircraft: (1) C-130E, (2) C-135A, (3) C-141, (4) DC-8, (5) Boeing 747, and (6) an augmentor-wing STOL. In addition, the wind shear effect on touchdown resulting from different locations of the center of gravity and gross weights was also analyzed. Author

N73-27024# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORTS, BRIEF FORMAT, US CIVIL AVIATION
18 May 1973 486 p
(NTSB-BA-73-6) Avail: NTIS HC $26.50

Selected aircraft accident reports, in brief format, occurring in U.S. civil aviation operations during calendar year 1972 are presented. The 898 General Aviation accidents contained in the publication represent a random selection. The brief format presents the facts, conditions, circumstances, and probable cause(s) for each accident. Additional statistical information is tabulated by type of accident, phase of operation, kind of flying, injury index, aircraft damage, conditions of light, pilot certificate, injuries, and causal factors. Author

N73-27025# Utah Univ., Salt Lake City. Coll. of Engineering.
PHYSIO-CHEMICAL STUDY OF SMOKE EMISSION BY AIRCRAFT INTERIOR MATERIALS. PART 2: RIGID AND FLEXIBLE URETHANE FOAMS Final Report
I. N. Einhorn, M. D. Kanakia, and J. D. Seader Jul. 1973 144 p refs Sponsored by FAA
(FAA-RD-73-50-Pt-2) Avail: NTIS HC $9.25

A study was conducted to determine the flammability characteristics and thermal degradation of urethane cellular plastics used in aircraft interiors. Initially, model urethane polymers, representative of systems used in aircraft interiors, were prepared, and the effect of the chemical structure of isocyanates and ployols on performance during fire exposure were studied. A series of non-fire-retarded rigid-urethane foams was synthesized and evaluated to serve as the basis for further research directed toward the synthesis of fire-retarded systems. Following this, a series of fire-retarded rigid foams was synthesized incorporating reactive and non-reactive fire retardants in various concentrations. The flammability characteristics of these cellular plastics were evaluated using test methods for the ease of ignition, flame propagation, fire endurance, smoke emission, and oxygen index as criteria. Author

N73-27026*# Boeing Co., Wichita, Kans.
STOL RIDE CONTROL FEASIBILITY STUDY
C. K. Gordon and R. O. Dodson Washington NASA Jul. 1973 103 p refs
(Contract NAS1-11683)
(NASA-CR-2276; D3-9052-1) Avail: NTIS HC $3.00 CSCL 01C

The feasibility of developing a ride-smoothing control system for a 20-passenger turboprop STOL transport was assessed. Five different ride-control system configurations with varying degrees of complexity, performance, and cost were investigated. Results indicate that a satisfactory ride-control system can be practically implemented on the aircraft with minimum flight performance degradation. Author

N73-27027*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
PRELIMINARY FLIGHT EVALUATION OF A PAINTED DIAMOND ON A RUNWAY FOR VISUAL INDICATION OF GLIDE SLOPE
Shu W. Gee and Robert C. McCracken Washington Aug. 1973 22 p refs
(NASA-TM-X-2849; H-739) Avail: NTIS HC $3.00 CSCL 05E

A diamond sized to appear equidimensional when viewed from a 3.6 deg slide slope was painted on the end of a small general aviation airport runway, and a series of flights was made to evaluate its usage as a piloting aid. The pilots could detect and fly reasonably close to the glide slope projected by the diamond. The flight path oscillations that were recorded during approaches using the diamond were not significantly different from the oscillations that were recorded without the diamond; the difference that did exist could be attributed to converging on a known projected glide slope in one case, and flying an unknown, random glide slope in the other. The results indicated that the diamond would be effective as a means of intercepting and controlling a predetermined glide slope. Other advantages of the diamond were positive runway identification and greater aim point visibility. The major disadvantage was a tendency to overconcentrate on the diamond and consequently to neglect cockpit instruments and airport traffic. Author

N73-27028*# Scientific Translation Service, Santa Barbara, Calif.
COMPARISON OF SIMULATION AND FLIGHT TEST FOR AUTOMATIC STOL LANDINGS
H. Boehret Washington NASA Jul. 1973 22 p Transl. into ENGLISH from DGLR report on the 3d Meeting of the DGLR-Symp. Flight Testing Technol. (West Germany), Oct. 1972 p

7-28 (See N73-19005 10-02)
(Contract NASw-2483)
(NASA-TT-F-14995) Avail: NTIS HC $3.25 CSCL 01C

The comparison of-simulation and flight test results for automatic STOL landings is presented. The subjects discussed are: (1) description of flight control system; (2) control of flight path during approach; (3) control of aerodynamic flow conditions; (4) description of simulator; (5) influence of nonlinearity; and (6) application of radar for altitude measurement. Author

N73-27029# European Space Research and Technology Center, Noordwijk (Netherlands).
AEROSAT EXPERIMENT USING STRATOSPHERIC BALLOONS
D. L. Brown Mar. 1973 10 p refs Presented at the Intern. Conf. on Satellite Systems for Mobile Commun. and Surveillance, London, 13-15 Mar. 1973
Avail: NTIS HC $3.00

A stratospheric balloon borne transponder to relay signals from a ground station to an aircraft flying over the sea, the objective being to assess and compare techniques which could be used in an L-band aeronautical satellite communication system prior to the final definition of the system. Author (ESRO)

N73-27030# Lockheed Missiles and Space Co., Palo Alto, Calif. Palo Alto Research Lab.
STUDY OF HIGH ALTITUDE AIRCRAFT WAKE DYNAMICS. TASK 2: MODEL DEVELOPMENT Final Report
H. Hoshizaki, K. O. Redler, J. W. Meyer, R. J. Conti, and L. B. Anderson Jan. 1973 80 p refs
(Contract DOT-OS-20082)
(PB-218820/9; DOT-TST-73-5) Avail: NTIS HC $3.00 CSCL 04A

A chemically-reacting wake model computer program has been formulated. The wake model program computes the wake height and width from the jet engine nozzle to the point in time where aerodynamic perturbations are small. The program also predicts the detailed chemical reactions that occur in the jet exhaust flow field. (Author Modified Abstract) GRA

N73-27031# Boeing Commercial Airplane Co., Seattle, Wash.
AIRCRAFT HYDRAULIC SYSTEM DYNAMICS Final Report, Jun. - Dec. 1972
Alvin W. Waterman, Arun K. Trikha, and Kenneth D. Groom Feb. 1973 58 p refs
(Contract F33615-72-C-1699; AF Proj. 3145)
(AD-757537; D6-41108; AFAPL-TR-73-2) Avail: NTIS HC $3.00 CSCL 01/3

It is desirable to use computerized analysis techniques in place of costly ground testing and outmoded hand calculations as methods of analyzing aircraft hydraulic system dynamic performance. The current potential for accomplishing this objective was assessed to establish recommendations for future development. Criteria established as desirable features were the use of digital programming and building-block concepts in each of three technical areas (transient response, frequency response, and thermal analysis) needed to describe a composite of system performance. Basic development work was determined to be accomplished in all three technical areas, but in no area did these efforts meet the USAF objectives. Transient response capability needs improvement to simulate frequency-dependent friction and cavitation characteristics. Frequency response programming requires much improvement in the technique for analyzing pump/system interactions. Thermal analysis steady-state analysis programming needs to be expanded to provide transient capability. These efforts are recommended to be accomplished in a coordinated 5-year program with continuous parallel effort being conducted in each of the three technical areas.
Author (GRA)

N73-27032# Transportation Systems Center, Cambridge, Mass.
ANALYTICAL STUDIES OF THE LIFT AND ROLL STABILITY OF A RAM AIR CUSHION VEHICLE Interim Report, Jul. 1971 - Jun. 1972
Timothy M. Barrows Dec. 1972 67 p refs
(Contract DOT-RR-307; TSC Proj. R-3316)
(PB-219820/8; DOT-TSC-FRA-72-10; FRA-RT-73-21) Avail: NTIS HC $3.00 CSCL 13F

A ram air cushion vehicle (a type of ram wing) is described schematically and compared with a conventional air cushion vehicle design. The nonlinear equations for the flow in the cushion region are derived. A review is made of the most recent literature on the subject of wings operating in a rectangular channel, and an approximate solution is developed which shows the relative effects of momentum and viscosity on the pressure distribution. Several analytic solutions are presented which show the effect of a small roll angle on the flow pattern; equations for the rolling moment coefficient are also obtained. It is recommended that future efforts be aimed at developing proper numerical techniques which can solve the nonlinear flow relations and that recent experimental efforts to obtain the lateral stability coefficients be continued and expanded. Author (GRA)

N73-27033# Grumman Aerospace Corp., Bethpage, N.Y.
TRACKED AIR CUSHION RESEARCH VEHICLE, UPDATED DYNAMIC ANALYSIS
R. Lee and R. Coppolino Oct. 1972 72 p refs
(Contract DOT-FR-10039)
(PB-218368/9; PMT-B4-R72-8; FRA-RT-73-18) Avail: NTIS HC $3.00 CSCL 13F

The TACRV Dynamics Simulation Program has been updated and specific suspension system analyses performed to reflect 'as built' vehicle dynamics. The two Phase programs which treated pitch plane and lateral dynamics separately are combined into one twenty degree of freedom model which has new models for the actuator/dampers, active suspension system, air cushions and sources of excitation. An analytical formulation of vehicle structural flexibility for future incorporation in the program is given. Sample program results for planned guideway perturbations are shown. Suspension system analyses cover the following areas: active suspension stability, nonlinear damping effects, and cushion pitch dynamics. Test results from the TACRV Ground Vibration Survey are presented. Author (GRA)

N73-27034# Army Natick Labs., Mass.
HELIUM BUBBLE SURVEY OF A PARACHUTE OPENING FLOW FIELD
Paul C. Klimas May 1972 23 p refs
(DA Proj. 1F1-62203-A-A33)
(AD-761098; USA-NLABS-TR-73-48-AD) Avail: NTIS CSCL 01/3

A velocity survey of the flow field surrounding an 18 inch nominal diameter flat circular parachute model was made using the helium bubble technique. Due to asymmetrical model behavior arising from optical limitations, only two points in the filling cycle were examined. The point at which the canopy first reaches full open (instant at which inflation is complete) and at a time late in the cycle when steady state flow conditions are reached. Bubble streaks were photographed by two synchronized, orthogonally mounted still cameras, and the particle velocities were calculated using the measured lengths of the images and the camera exposure times. Although the canopy geometries at the two points considered were quite similar, their surrounding flow fields were not. (Author Modified Abstract) GRA

N73-27035# Army Materials and Mechanics Research Center, Watertown, Mass.
EVALUATION OF ADVANCED ULTRASONIC TESTING TECHNIQUES FOR DIFFUSION-BONDED TITANIUM ALLOY AIRCRAFT STRUCTURES
Robert H. Brockelman Apr. 1973 34 p refs
(DA Proj. 1T0-62105-A-331)
(AD-760673; AMMRC-TR-73-16) Avail: NTIS CSCL 01/3

The report describes the initial effort to develop effective nondestructive test methods for diffusion-bonded titanium aircraft components. It was demonstrated that several ultrasonic techniques have the potential for overcoming the extraneous background scattering noise normally encountered in titanium structures thereby improving the sensitivity to defect detection at the bond joint. The ultrasonic techniques examined were high resolution flaw detection, spectroscopy and compound scan. Author (GRA)

N73-27036# Calspan Corp., Buffalo, N.Y.
IN-FLIGHT SIMULATION OF MINIMUM LONGITUDINAL

STABILITY FOR LARGE DELTA-WING TRANSPORTS IN LANDING APPROACH AND TOUCHDOWN. VOLUME 1: TECHNICAL RESULTS Final Report
Richard Wasserman and John F. Mitchell Washington, D. C. FAA Feb. 1973 133 p refs
(Contracts F33615-72-C-1386; DOT-FA72WAI-143; AF Proj. 920K; FAA Proj. 181-524-047)
(AD-761120; AK-5084-F-1; AFFDL-TR-72-0143; FAA-RD-73-43) Avail: NTIS CSCL 01/3

An in-flight simulation to investigate minimum longitudinal stability for large delta-wing transports in landing approach and touchdown (including ground effect) was conducted using the USAF/Calspan Total In-Flight Simulator (TIFS) airplane. Aerodynamic, inertial and control data for this class of airplane were obtained from a prototype Concorde package supplied by the FAA. The simulation program involved the examination of 20 configurations by four evaluation pilots. The configurations evaluated were based upon a systematic variation of the longitudinal stability characteristics for this class of airplane. These variations were designed to examine the influence of pitch stiffness, backsideness, pitch damping and nonlinear pitching moment effects on pilot acceptability of minimum longitudinal stability for the landing approach task. A total of 61 evaluations was performed. (Author Modified Abstract) GRA

N73-27037# Franklin Inst. Research Labs., Philadelphia, Pa.
REDUCTION OF REFLECTIONS FROM HELICOPTER WINDSHIELDS, ROTOR BLADES AND ROTOR HUB
John A. DeBenedictis and John W. Woestman Apr. 1973 74 p refs
(Contract DAAD05-71-C-0422)
(AD-761127; C3120-08; LWL-CR-06P73A) Avail: NTIS CSCL 01/3

The report addresses itself to the problem of reducing reflections from helicopters. Specific areas investigated are the windshields, rotor blades and rotor hub assembly. All feasible ideas, however remote, were solicited and considered. Recommendations are divided into general sub-categories for each area and are presented with estimates of their potential effectiveness. The body of the report is composed of a technical discussion of every potential solution as well as related precautions to heed and specific evaluations to consider. The references and bibliography provides the reader with an up-to-date comprehensive listing of studies, products and techniques related to the problem of reflected light from helicopters. Author (GRA)

N73-27038# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DESIGN OF FIXED GAIN COMPENSATOR SYSTEM FOR THE LONGITUDINAL AXIS OF THE C-141 FLY-BY-WIRE AIRCRAFT M.S. Thesis
Larry D. Kwasigroh Mar. 1973 168 p refs
(AD-760763; GGC/EE/71-12) Avail: NTIS CSCL 01/3

The report presents an attempt to design a fixed gain control system for the longitudinal axis of the C-141 fly-by-wire aircraft. Classical control theory using root locus and frequency response (Bode) techniques was used throughout the design process. It was found that a quadratic over quadratic compensator, inserted in the forward path of the C* control loop, improved the system response even with the original discrete gains. With slightly relaxed constraints on the C* performance (* envelope was originally designed for fighter aircraft), a single fixed gain in the C* loop produced acceptable C* Category 3 responses. An additional quadratic over quadratic compensator was designed for the pitch attitude control loop; however, the acceptability of the attitude response with a fixed gain is questionable. (Author Modified Abstract) GRA

N73-27039# Army Air Mobility Research and Development Lab., Fort Eustis, Va.
DYNAMIC COMPATIBILITY OF ROTARY-WING AIRCRAFT PROPULSION COMPONENTS
John M. Vance Jan. 1973 61 p refs
(DA Proj. 1G1-62207-A-A71)
(AD-761100; USAMMRDL-TR-73-10) Avail: NTIS CSCL 01/3

A study of problems related to vibration and dynamic loads in helicopter propulsion systems was made. It was found that engine vibration, shaft whirling, and dynamic instabilities seriously limit helicopter performance and reliability. It is recommended that studies be made to justify an intelligent standardization of engine vibration limit specifications for helicopters, that impedance-mobility methods be developed for optimizing engine/airframe interface design, that research and development of helicopter power transmission shafts and couplings be carried out to solve whirling problems, and that new methods and hardware be developed to eliminate torsional instabilities in helicopter drive systems with automatic fuel control.
Author (GRA)

N73-27040# Naval Air Development Center, Warminster, Pa. Crew Systems Dept.
NAVY VEHICLE DESIGN AND CONSTRUCTION: MEASUREMENT OF TRIAXIAL VIBRATION AT SIGNIFICANT HUMAN INTERFACE POINTS ON THE CH-47C AND SH-3A HELICOPTERS Final Report
Charles W. Hutchins 31 Dec. 1972 70 p refs
(AD-761199; NADC-72226-CS; JANAIR-721122) Avail: NTIS CSCL 01/3

Triaxial vibration levels were recorded on the CH-47C and SH-3A helicopters at the pilot:s seat, collective control stick, rudder pedal, instrument panel, and the pilot's head (Z-axis only). These recordings were made on two separate two-hour flights for both helicopters. The first flight was a continuous mission profile representative of the helicopters: primary mission. The second flight consisted of discrete maneuvers representative of a broad scope of mission profiles. The resulting vibration tapes were subjected to spectrum analysis and three peak frequencies found. These peaks were seen to be a function of the rotor head frequency and two harmonics of this frequency. Each of the three peak frequencies was shown to be critical in terms of human performance parameters. Author (GRA)

N73-27041# Hughes Aircraft Co., Culver City, Calif.
FLIGHT EVALUATION OF OPTIMAL COMMANDS FOR F-1 MINIMUM TIME CLIMB AND ACCELERATION Final Technical Report, Oct. 1970 - Nov. 1972
John A. Schiro and Thomas J. SHYKULA Wright-Patterson AFB, Ohio AFFDL Mar. 1973 112 p refs
(Contract F33615-71-C-1017; AF Proj. 8222)
(AD-760571; HAC-Ref-C2090; AFFDL-TR-73-32) Avail: NTIS CSCL 01/3

The background and results of a flight test program to examine the comparative time advantages of an energy optimization climb and acceleration methodology, in contrast to present F-106 handbook procedures, is described. The optimum procedure was implemented in the F-106 airborne digital computer, and provided a single control error signal to indicate deviations from an optimum flight profile. Flight results indicated that time savings as great as 24 percent in climb, and 27 percent in acceleration are achievable. Operational aircraft performance variations, however, prevented consistent realization of the maximum time savings. The steering signal and display were shown to provide proper indication over some portions of the flight regime, while exhibiting erratic behavior during rapid transition flight phases. (Author Modified Abstract) GRA

N73-27042# Goodyear Aerospace Corp., Akron, Ohio.
DEVELOPMENT OF A FREE BALLOON PROPULSION SYSTEM Final Report, 22 Sep. 1971 - 22 Feb. 1973
Jerome J. Vorachek, Edward W. McGraw, and John W. Bezbatchenko 22 Feb. 1973 158 p refs
(Contract F19628-72-C-0072)
(AD-760754; GER-15871; AFCRL-TR-73-0128) Avail: NTIS CSCL 01/3

Design, fabrication, development and testing of a free balloon propulsion system for flight at 60,000 feet and 15 knot true airspeed is reported. The mission of this system was to demonstrate the feasibility of powering a natural shape balloon in the minimum wind layer. The propulsion system consists of a 35.4 foot diameter propeller driven through a gearbox by a dc electric motor. The electric motor is powered by a group of silver zinc batteries. Steering of the gondola and balloon system is accomplished with a rudder in the propeller slipstream. A command control and telemetry system is used to control the balloon and propulsion payload. The propulsion system (less

propeller) was tested in an altitude chamber to verify proper functioning under high altitude, low temperature conditions. (Author Modified Abstract) GRA

N73-27043# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRICAL MODELING OF ELASTIC VIBRATIONS OF A WING
T. V. Pavelko 21 May 1973 16 p refs Transl. into ENGLISH from Vopr. Ekspluatatsionnoi Prochnost, i Nadezhnosti Aviats. Konstruktsii (Riga), v. 6, no. 191, 1971 p 93-102
(AD-760965; FTD-HT-23-260-73) Avail: NTIS CSCL 01/3
The report describes electromodeling of the motion of a wing in flight under the action of a distributed load with consideration of displacement of the center of gravity of the aircraft and its rotation as a solid body. GRA

N73-27044# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRICAL MODEL OF A DELTA WING
E. R. Suvorova 17 May 1973 12 p refs Transl. into ENGLISH from Vop. Electromodelirovaniya Aviakonstruktsiy (USSR), v. 196, no. 1, 1971 p 30-35
(AD-760948; FTD-HT-23-0263-73) Avail: NTIS CSCL 01/3
The report describes the development of an electrical circuitry for studying the stress-deformation state of a model of a delta wing on the basis of a discrete design diagram. GRA

N73-27045# Aerophysics Research Corp., Bellevue, Wash.
OPTIMAL DESIGN INTEGRATIONS OF MILITARY FLIGHT VEHICLES (ODIN/MFV) Final Report, May 1971 - Sep. 1972
D. S. Hague and C. R. Glatt Dec. 1972 592 p refs
(Contract F33615-71-C-1480; AF Proj. 1431)
(AD-760568; AFFDL-TR-72-132) Avail: NTIS CSCL 01/3
ODIN/MFV is a digital computing system for the synthesis and optimization of military flight vehicle preliminary designs. The system consists of a library of technology modules in the form of independent computer programs and an executive program, DIALOG, which operates on the technology modules. The technology module library contains programs for estimating military flight vehicle characteristics, for example, aerodynamics, trajectory and geometry. In addition a generalized optimization module, plotting module, and a program precompiler are available in the technology module library. The initial program library was limited to only a few programs due to the limited scope of the study; however, other programs may readily be introduced into the library by a minor program modification. (Author Modified Abstract) GRA

N73-27046# Army Combat Developments Command Supply Agency, Fort Lee, Va.
AIRCRAFT REFUELING AND REARMING IN FORWARD AREAS (FARR). VOLUME 1: MAIN REPORT AND APPENDIXES A-F Final Study
Nov. 1972 114 p refs
(AD-760524) Avail: NTIS; paper copy also available from NTIS $4.75/set of 2 reports as AD-760524 - set CSCL 01/3
The report identifies and examines the organizations, doctrine, and equipment utilized in refueling and rearming Army aircraft in forward areas. The time frame addressed is current (up to 1975). Both qualitative and quantitative types of analyses are made. The study determines the personnel and equipment required by specific nondivisional, separate brigade/regiment, and divisional aviation units for accomplishing forward area refueling and rearming (FARR) operations. In addition, a supplementary FARR capability is proposed for attachment or assignment to supporting headquarters, as required. Revisions also are indicated which should be made to field manuals and tables of organization and equipment by proponent agencies, upon approval of this study. Author (GRA)

N73-27047# Army Combat Developments Command Supply Agency, Fort Lee, Va.
AIRCRAFT REFUELING AND REARMING IN FORWARD AREAS (FARR). VOLUME 2: APPENDIXES G-P Final Study
Nov. 1972 238 p refs
(AD-760525) Avail: NTIS; paper copy also available from NTIS $4.75/set of 2 reports as AD-760524 - set CSCL 01/3
The report identifies, examines and analyzes questionnaires sent to overseas commands, current doctrine, MOS capabilities, armament subsystems and refueling equipment. A composite service organization is structured. A statistical analysis is performed to determine organizational level of assignment, the number of personnel and amount of equipment required to support the operation. Author (GRA)

N73-27048# Boeing Co., Seattle, Wash. Commercial Airplane Group.
THE 727 NOISE RETROFIT FEASIBILITY. VOLUME 1: LOWER GOAL DESIGN, FABRICATION, GROUND AND FLIGHT TESTING Final Report, Jul. 1971 - Mar. 1972
R. B. Tate, H. G. Ripley, and J. A. Lambert Mar. 1972 62 p refs
(Contract DOT-FA71WA-2637)
(AD-756040; FAA-RD-72-40-Vol-1) Avail: NTIS CSCL 21/5
The work performed in Phase 1 of the contract was design, fabrication, and ground testing of a treated nacelle configuration conforming to the FAA lower noise reduction goals for the 727 airplane. The nacelle configuration tested consists of acoustically treated side engine inlet, fan duct and tailpipe. This nacelle configuration was developed by the Boeing Company, flight tested and certificated in July 1971. The same nacelle was then used to conduct the contract Phase 1 ground tests to obtain comparative acoustic and performance data with the basic, or tare, nacelle. In addition, a cost analysis was prepared showing the retrofit kit installation and direct operating cost (DOC) charged to the 727 airplane with a Phase 1 quiet nacelle. The results of the flight testing, not a part of this contract, are included in this report. Author (GRA)

N73-27487 Army Air Mobility Research and Development Lab., Fort Eustis, Va. Structures Div.
ADVANCES IN BALLISTICALLY TOLERANT FLIGHT CONTROLS
I. E. Figge, Sr. *In* AGARD Impact of Composite Mater. on Aerospace Vehicles and Propulsion Systems May 1973 8 p refs (For availability see N73-27474 18-18)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; Nuclear Engineering; and 28 Propulsion Systems.

N73-27049*# Stanford Research Inst., Menlo Park, Calif.
INORGANIC SEPARATOR TECHNOLOGY PROGRAM Final Report, Dec. 1970 - Nov. 1972
Joseph S. Smatko, Robert D. Weaver, and Fritz R. Kalhammer Jan. 1973 192 p refs
(NASA-CR-121215; SRI-SCU-1377) Avail: NTIS HC $11.75 CSCL 10C
Testing and failure analyses of silver zinc cells with largely inorganic separators were performed. The results showed that the wet stand and cycle life objective of the silver-zinc cell development program were essentially accomplished and led to recommendations for cell composition, design, and operation that should yield further improvement in wet and cycle life. A series of advanced inorganic materials was successfully developed and formulated into rigid and semiflexible separator samples. Suitable screening tests for evaluation of largely inorganic separators were selected and modified for application to the separator materials. The results showed that many of these formulations are potentially superior to previously used materials and permitted selection of three promising materials for further evaluation in silver-zinc cells. Author

N73-27050# Solar, San Diego, Calif.
DESIGN STUDY OF GAS TURBINE GENERATOR SETS IN 30 KW AND 60 KW SIZES Final Report, 20 Apr. - 20 Sep. 1972

Leland Blinman Nov. 1972 226 p ref
(Contract DAAK02-72-C-0308; DA Proj. 1G6-63702-G-11)
(AD-761115; FR-2412) Avail: NTIS CSCL 10/2

The optimum design 30 kW generator set reflecting the objectives of 1.7 lb/kW-hr specific fuel consumption and the need of a minimum engineering development program is established and described for 50/60 Hz and 400 Hz configurations. Engine design, generator, controls, starter, accessories, and package design tradeoffs are made and cost estimates developed for production quantities. Limited information is included for 60 kW generator sets and some data are developed for turboalternator designs. Author (GRA)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N73-27051*+ National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 115, MAY 1973
May 1973 99 p refs
(NASA-SP-7011(115)) Avail: NTIS HC $3.00 CSCL 06E

This special bibliography lists 324 reports, articles and other documents introduced into the NASA scientific and technical information system in April 1973. Author

N73-27052* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METHOD OF DETECTING AND COUNTING BACTERIA IN BODY FLUIDS Patent
Emmett W. Chappelle and Grace L. Picciolo, inventors (to NASA) Issued 10 Jul. 1973 8 p Field 30 Apr. 1971 Continuation-in-part of abandoned US Patent Appl. SN-60950, filed 4 Aug. 1970
(NASA-Case-GSC-11092-2; US-Patent-3,745,090; US-Patent-Appl-SN-139250; US-Patent-Class-103.5R; US-Patent-Appl-SN-60950) Avail: US Patent Office CSCL 06M

A novel method is reported for determining bacterial levels in urine samples, which method depends on the quantitative determination of bacterial adenosine triphosphate (ATP) in the presence of non-bacterial ATP. After the removal of non-bacterial ATP, the bacterial ATP is released by cell rupture and is measured by an enzymatic bioluminescent assay using an enzyme obtained from the firefly. Official Gazette of the U.S. Patent Office

N73-27053# Joint Publications Research Service, Arlington, Va.
THE STATE AND PROSPECTS OF BIOGEOCENOLOGICAL RESEARCH
M. A. Golubets 29 Jun. 1973 16 p refs Transl. into ENGLISH from Visn. Akad. Nauk Ukr. RSR (Ukrainia SSR), no. 1, 1973 p 76-84
(JPRS-59395) Avail: NTIS HC $3.00

A discussion is presented of biogeocenology which is the theoretical basis of the protection, restoration, and multiplication of the biological resources of our planet. Author

N73-27054*# Kanner (Leo) Associates, Redwood City, Calif.
STIMULATION OF PANTING BY ISOLATED HEATING OF THE SPINAL COLUMN IN THE WAKE DOG
C. Jessen Washington NASA Jul. 1973 25 p refs Transl. into ENGLISH from Pfluegers Arch. (West Ger.), v. 297, 1967 p 53-70
(Contract NASw-2481)
(NASA-TT-F-14998) Avail: NTIS HC $3.25 CSCL 06C

In 10 wake dogs, the spinal cord was heated selectively by means of a polythene thermode implanted semipermanently in the peridural space; 58 heating periods were applied in 25 experiments at ambient air temperatures of 19 to 27 C. In five animals selective heating of the spinal cord regularly led to an increase in respiratory rate and to panting, which resembled thermal panting under external heat stress. The extent to which respiratory rate was increased was found to be dependent on the intensity of heating and on the levels of internal and ambient temperatures. The results indicate that thermal stimuli applied to the spinal cord do not only affect the mechanisms of shivering and of cutaneous blood flow, but also influence the supraspinal mechanisms of respiratory heat dissipation. Therefore, thermal stimuli to the spinal cord must be conducted to higher levels of the central nervous system. Author

N73-27055# Civil Aeromedical Inst., Oklahoma City, Okla.
TRANSIENT BLINDNESS DUE TO THE COMBINED EFFECTS OF MEVINPHOS AND ATROPINE
Alvin M. Revzin Feb. 1973 5 p refs
(FAA-AM-73-4) Avail: NTIS HC $3.00

Three squirrel monkeys did not respond to visual stimuli for at least one hour following combined administration of mevinphos (Phosdrin) and atropine. Therefore, aerial applicator personnel being treated for mevinphos (Phosdrin) poisoning with atropine may show potentially hazardous dysfunctions of visual perception. Some mechanisms for this effect were discussed. Author

N73-27056# Civil Aeromedical Inst., Oklahoma City, Okla.
SUBTLE CHANGES IN BRAIN FUNCTIONS PRODUCED BY SINGLE DOSES OF MEVINPHOS (PHOSDRIN)
Alvin M. Revzin Feb. 1973 8 p refs
(FAA-AM-73-3) Avail: NTIS HC $3.00

Mevinphos (Phosdrin) was found to inhibit the amplitude of hippocampal evoked potentials in unanesthetized squirrel monkeys with chronically in-dwelling electrodes. The threshold dose was 0.050 mg/kg and the maximal dose studied was 0.200 mg/kg. Doses above 0.200 mg/kg induced hippocampal seizures. Within the dose range of 0.050 mg/kg to 0.200 mg/kg the amplitude and duration of the inhibition were directly proportional to dose. No peripheral signs of poisoning, such as tremor or salivation, were seen at doses of 0.200 mg/kg or under. The discussion emphasizes that mevinphos produces changes in brain function in the absence of the peripheral symptomatology usually taken as indicators of poisoning by aerial applicator personnel. Therefore, it is concluded that exposure to mevinphos may be unexpectedly hazardous since that areial applicators may be unaware that they have been poisoned. Author

N73-27057*# National Aeronautics and Space Administration, Washington, D.C.
INVESTIGATIVE METHODS IN SPACE BIOLOGY AND MEDICINE: TRANSMISSION OF MEDICAL DATA
R. M. Bayevskiy and W. R. Adey Jul. 1973 60 p refs Transl. into ENGLISH from the publ. "Osnovy Kosmicheskoy Biologii i Meditsiny" Moscow, Nauka, 1973 p 1-86
(NASA-TT-F-14996) Avail: NTIS HC $5.00 CSCL 06E

Physiological measurement systems and methods of clinico-physiological examination in space flight are discussed along with telemetry. Recommendations for improving physiological measurements in space are included. F.O.S.

N73-27058*# Stanford Research Inst., Menlo Park, Calif.
AROUSAL FROM SLEEP BY NOISES FROM AIRCRAFT WITH AND WITHOUT ACOUSTICALLY TREATED NACELLES
J. S. Lukas, D. J. Peeler, and M. E. Dobbs Washington NASA Jul. 1973 51 p refs
(Contract NAS1-11243)
(NASA-CR-2279) Avail: NTIS HC $3.00 CSCL 06S

The electroencephalographic and behavioral responses during sleep of four subjects, aged 46 to 58 years, to three types of noises were tested over 14 consecutive nights. The stimuli were two DC-8 jet landing noises (each 30 seconds in duration and coming from DC-8 aircraft with and without acoustical treatment on the engine nacelles) and a 4-second burst of pink noise. Each of the noises was tested at nominal intensities of 61 and 79 dBA. Other physical descriptors of the noises were measured or computed. The results indicate that for an equivalent degree of sleep disruption, noise from the jet aircraft with untreated nacelles must be about 6 dBA less intense than the jet with acoustically treated nacelles. Predictions of the effects of noise on sleep appear, tentatively, to attain the highest accuracy when the physical descriptor of noise intensity includes information

about the impulsive characteristics of that noise as well as its long-term spectral content. Author

N73-27059*# Stanford Univ., Calif. Instrumentation Research Lab.
CYTOCHEMICAL STUDIES OF PLANETARY MICRO-ORGANISMS - EXPLORATIONS IN EXOBIOLOGY Summary Report, 1 Jan. - 31 Dec. 1972
Joshua Lederberg 31 Dec. 1972 44 p refs
(Grant NGR-05-020-004; Contract ARPA SD-183; Grants GM-00612; RR-00311; GM-17367)
(NASA-CR-133272; IRL-1158) Avail: NTIS HC $4.25 CSCL 06C

Analytical methodology using gas chromatography and mass spectrography for improved physiological monitoring of astronauts is developed. Reported research covers the following topics: (1) Chlorination of DNA bases; (2) mass fragmentography; (3) mass spectrometry; (4) urine analysis for metabolic constituents; (5) analysis of natural products by mass spectrometry; (6) computer identification of unknown molecular compounds; (7) fluorescent sorter for cell separation; (8) Mariner Mars 1971 orbital photography; and (9) Viking Lander imagery. G.G.

N73-27060# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
PREFLIGHT HEAT STRESS AND RECOVERY
Fritz K. Klemm, Abbott T. Kissen, and John F. Hall, Jr. Feb. 1973 14 p refs
(AF Proj. 7222)
(AD-759173; AMRL-TR-72-87) Avail: NTIS CSCL 06/19

Changes in physiological responses during heat stress as experienced in summer preflight operations have been studied with four sitting, resting subjects wearing Air Force standard fighter clothing assemblies. After exposure to chamber temperatures of 45, 50, and 55C (25 mm Hg water vapor pressure and 1.1 m/sec air velocity) for either 30 or 60 minute periods, the temperatures were lowered rapidly (5 minutes) to 15, 20, and 25C, respectively, for a 30-minute poststress recovery period. Skin temperature, rectal temperatures, heart rates, body heat storages, sweat and evaporation rates were determined and graphically presented. The time required to return to prestress baseline physiological values for all thermal stress conditions is given in tabular form. As expected, recovery time was a function of the ambient recovery temperature level that followed the heat exposure. The recovery temperature should not be lower than 20C if discomfort is to be avoided. Heart rate decrease appears to be a reliable indicator for recovery. The rectal temperature remained at an elevated level after all other measured physiological responses returned to baseline level. In an additional series, applying identical heat stresses, the subject's head was ventilated with 2.5 CFM dry air at 10C. In comparison to the experiments without head ventilation, reduced skin temperatures and increased evaporation rates were observed. Author (GRA)

N73-27061# Michigan Coll. of Osteopathic Medicine, Pontiac.
THE EFFECTS OF OXYGEN AT HIGH PRESSURE ON CATECHOLAMINE METABOLISM Final Report
Rodney T. Houlihan 31 Dec. 1972 10 p refs
(Contract N00014-70-A-0159-0001; NR Proj. 101-654)
(AD-759405; Rept-301) Avail: NTIS CSCL 06/19

The involvement of epinephrine oxidation and indole production during acute oxygen poisoning was investigated. Cyclic oxidation of epinephrine has been verified. Adrenalectomy, which protects animals from oxygen toxicity, inhibits indole production. Enzyme activity is significantly increased during exposure to high pressure oxygen. There are species differences with respect to lung changes following seizures induced by hyperbaric oxygen. (Author Modified Abstract) GRA

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N73-27062* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPHTHALMIC METHOD AND APPARATUS Patent
John C. Evvard, William J. McGannon, and Donald J. Vargo, inventors (to NASA) Issued 5 Jun. 1973 4 p Filed 15 Nov. 1971 Supersedes N73-23079 (11 - 14, p 1613)
(NASA-Case-LEW-11669-1; US-Patent-3,736,938; US-Patent-Appl-SN-198885; US-Patent-Class-128-305; US-Patent-Class-128-2; US-Patent-Class-128-24A; US-Patent-Class-32-28; US-Patent-Class-32-58) Avail: US Patent Office CSCL 06L

A method and apparatus for removing material and components such as the lens from an eye is described. High speed rotary cutting members at one end of a rod macerate the lens while an annular tubing disposed around the cutting members vibrates ultrasonically to coact with the cutting members in macerating the lens. At the same time, a liquid is supplied to the chamber behind the cornea of the eye. Spiral grooves extending along the rotating rod from the cutting members evacuate the liquid and the macerated material from the eye. An alternate embodiment of the apparatus includes a tube through which liquid is supplied to the operative site of the ultrasonically vibrating tube and the cutting members in the area of the lens.
Official Gazette of the U.S. Patent Office

N73-27063 Stanford Univ., Calif.
INVESTIGATION OF AN ASTRONAUT MANEUVERING SCHEME Ph.D. Thesis
Michael Ray Headrick 1972 105 p
Avail: Univ. Microfilms Order No. 73-4512

A series of experiments which establish the feasibility of limb controlled maneuvering is described. These experiments use a weightlessness simulator which, in broad outline, operates as follows. The torso of the test subject is strapped to a gimbaled head which is mounted upon a moving carriage such that the torso has six degrees of freedom. The subject is free to move his arms, and certain angles which describe the position of the arms relative to the torso are monitored electrically. The subject is also free to turn thrusters on or off, and this activity is monitored electrically. The electrical signal from the arm angle sensors and the thrust control are transmitted to a hybrid analog-digital computer, which integrates equations of motion to determine the behavior the torso would have in free space and causes servomotors to drive the torso correspondingly. The resulting torso motion reflects the human capability to use the maneuvering concept since this motion is generated from the test subject's response to his perception of his state of motion.
Dissert. Abstr.

N73-27064# Joint Publications Research Service, Arlington, Va.
MAN AND HIS ENVIRONMENT
27 Jun. 1973 47 p Transl. into ENGLISH from Vopr. Filosofii (Moscow), nos. 1 and 2, 1973 p 48-60, 36-52
(JPRS-59369) Avail: NTIS HC $4.50

Materials from a roundtable meeting of scholars devoted to consideration of the interrelationship between man and his environment are presented. Author

N73-27065# Joint Publications Research Service, Arlington, Va.
INTERACTION BETWEEN MAN AND BIOSPHERE
M. I. Budyko 26 Jun. 1973 16 p refs Transl. into ENGLISH from Vopr. Filosofii (Moscow), no. 1, 1973 p 61-70
(JPRS-59366) Avail: NTIS HC $3.00

The changes in the balanced nature of the biosphere as a result of the coming of man are described. Author

N73-27066# Civil Aeromedical Inst., Oklahoma City, Okla.
JOB ATTITUDES OF AIR TRAFFIC CONTROLLERS: A COMPARISON OF THREE AIR TRAFFIC CONTROL SPECIALTIES
Roger C. Smith Jan. 1973 34 p refs
(FAA-AM-73-2) Avail: NTIS HC $3.75

A total of 792 journeyman air traffic controllers answered a four-part questionnaire concerning: (1) what they liked and

disliked about ATC work; (2) how much they liked or disliked certain specific aspects of ATC work, (3) how they felt about shift work, and (4) their level of job satisfaction. They liked most of their job tasks and the challenge of ATC work; they tended to dislike management, their work schedules, and job tasks not directly related to traffic control or flight service. Concerning shift work, it was found that the most negative attitudes were associated with night shifts. Controllers also indicated a preference for rapid turn-around shift rotation schedules. Finally, these satisfaction questionnaires indicated that approximately 91% of the controllers surveyed were satisfied with their occupational choice. Author

N73-27067*# Scientific Translation Service, Santa Barbara, Calif.
BIOLOGICAL LIFE SUPPORT SYSTEMS
Ye. Ya. Shepelev Washington NASA Jul. 1973 113 p refs Transl. into ENGLISH from Osnovy Kosmich. Biol. i Med. (Moscow), v. 3, pt. 3, ch. 3, 1973 p 1-115
(Contract NASw-2483)
(NASA-TT-F-15005) Avail: NTIS HC $7.75 CSCL 05E

The development of a human living environment by biological methods utilizing the appropriate functions of atrophic and heterotrophic organisms is discussed. Certain properties of natural biological systems and a simulated biological life support system are discussed. The problems and prospects for the development of individual functional links in biological life support systems are presented. Author

N73-27068*# National Aeronautics and Space Administration, Washington, D.C.
SAFETY OF LIFE AND HEALTH OF CREWS OF SPACECRAFT AND SPACE STATIONS IN EMERGENCY SITUATIONS
I. N. Chernyakov Jul. 1973 38 p refs Transl. into ENGLISH from the publ. "Osnovy Kosmicheskoy Biologii i Meditsiny" Moscow, Acad. of Sci., 1973 p 1-64
(NASA-TT-F-14997) Avail: NTIS HC $4.00 CSCL 05E

The research is reported on the problems of life support for cosmonauts in emergency situations, during flight, for depressurization, fire, and the failure of air regeneration systems. Attention is focused on the effectiveness of on-board rescue resources. F.O.S.

N73-27069*# Michigan Univ., Ann Arbor.
THE USE OF A TRACKING TEST BATTERY IN THE QUANTITATIVE EVALUATION OF NEUROLOGICAL FUNCTION
Brian S. Repa [1973] 147 p refs
(Contract NSR-23-005-364)
(NASA-CR-132275) Avail: NTIS HC $9.50 CSCL 05E

A number of tracking tasks that have proven useful to control engineers and psychologists measuring skilled performance have been evaluated for clinical use. Normal subjects as well as patients with previous diagnoses of Parkinson's disease, multiple sclerosis, and cerabral palsy were used in the evaluation. The tests that were studied included step tracking, random tracking, and critical tracking. The results of the present experiments encourage the continued use of tracking tasks as assessment precedures in a clinical environment. They have proven to be reliable, valid, and sensitive measures of neurological function. Author

N73-27070# Joint Publications Research Service, Arlington, Va.
DEVELOPMENT OF MAN-COMPUTER INTERACTION
G. L. Smolyan 29 May 1973 21 p refs Transl. into ENGLISH from Vopr. Filosofii (Moscow), no. 3, 1973 p 30-43
(JPRS-59149) Avail: NTIS HC $3.25

The problem of interaction between man and computers, as a primary factor in raising the efficiency of man-machine systems of control and data processing is examined. Author

N73-27071*# AiResearch Mfg. Co., Torrance, Calif.
STUDY AND DEVELOPMENT OF A CRYOGENIC HEAT EXCHANGER FOR LIFE SUPPORT SYSTEMS Final Report
M. M. Soliman 23 Mar. 1973 167 p refs
(Contract NAS8-28099)
(NASA-CR-124301; Rept-73-9117) Avail: NTIS HC $10.50 CSCL 06K

A prototype cryogenic heat exchanger for removal of waste heat from a spacecraft environmental control life support system was developed. The heat exchanger uses the heat sink capabilities of the cryogenic propellants and, hence, can operate over all mission phases from prelaunch to orbit, to post landing, with quiescent periods during orbit. A survey of candidate warm fluids resulted in the selection of E-2, a fluorocarbon compound, because of its low freezing point and high boiling point. The final design and testing of the heat exchanger was carried out, however, using Freon-21, which is similar to E-2 except for its low boiling point. This change was motivated by the desire for cost effectiveness of the experimental program. The transient performance of the heat exchanger was demonstrated by an analog simulation of the heat sink system. Under the realistic transient heat load conditions (20 sec ramp from minimum to maximum Freon-21 inlet temperature), the control system was able to maintain the warm fluid outlet temperature within + or - 3 F. For a 20-sec ramp from 0 F to -400 F in the hydrogen inlet temperature, at maximum heat load, the warm fluid outlet temperature was maintained within + or - 7 F. Author

N73-27072*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Biotechnology and Power Dept.
COST ANALYSIS OF LIFE SUPPORT SYSTEMS Final Report
M. M. Yakut Jun. 1973 58 p refs
(Contract NAS8-28377)
(NASA-CR-124305; MDC-G4630) Avail: NTIS HC $5.00 CSCL 06K

A methodology was developed to predict realistic relative cost of Life Support Systems (LSS) and to define areas of major cost impacts in the development cycle. Emphasis was given to tailoring the cost data for usage by program planners and designers. The equipment classifications used based on the degree of refinement were as follows: (1) Working model; (2) low-fidelity prototype; (3) high-fidelity prototype; and (4) flight-qualified system. The major advanced LSS evaluated included the following: (1) Carbon dioxide removal; (2) oxygen recovery systems; (3) water recovery systems; (4) atmosphere analysis system. Author

N73-27073*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Biotechnology and Power Dept.
COST ANALYSIS OF CARBON DIOXIDE CONCENTRATORS Final Report
M. M. Yakut Jun. 1973 54 p refs
(Contract NAS8-28377)
(NASA-CR-124302; MDC-G4631) Avail: NTIS HC $4.75 CSCL 06K

Methodology and cost estimating relationships, for flight-type and prototype CO2 concentrators, have been developed and presented. A validity check was made by comparing the molecular sieves system considered here and that developed for Skylab. The system evaluated here is twice the size of the Skylab system and is also more complex as it desorbs CO2 thermally and stores it in an accumulator. The cost estimates developed were found to be approximately 50 to 70% higher than the actual cost of the Skylab unit. Author

N73-27074*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Biotechnology and Power Dept.
COST ANALYSIS OF WATER RECOVERY SYSTEMS
M. M. Yakut Jun. 1973 87 p refs
(Contract NAS8-28377)
(NASA-CR-124303; MDC-G4632) Avail: NTIS HC $6.50 CSCL 06K

A methodology was developed to predict the relevant contributions of the more intangible cost elements encountered in the development of flight-qualified hardware based on an extrapolation of past hardware development experience. Major items of costs within water recovery systems were identified and related to physical and/or performance criteria. Cost and performance data from Gemini, Skylab, and other aerospace and biotechnology programs were analyzed to identify major cost elements required to establish cost estimating relationships for advanced water recovery systems. The results of the study are expected to assist NASA in long-range planning and allocation

of resources in a cost effective manner in support of earth orbital programs. This report deals with the cost analysis of the five leading water reclamation systems, namely: (1) RITE waste management-water system, (2) reverse osmosis system, (3) multifiltration system, (4) vapor compression system, and (5) closed air evaporation system with electrolytic pretreatment.
Author

N73-27076*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Biotechnology and Power Dept.
COST ANALYSIS OF OXYGEN RECOVERY SYSTEMS
M. M. Yakut Jun. 1973 57 p refs
(Contract NAS8-28377)
(NASA-CR-124304; MDC-G4633) Avail: NTIS HC $5.00 CSCL 06K

The design and development of equipment for flight use in earth-orbital programs, when optimally approached cost effectively, proceed through the following logical progression: (1) bench testing of breadboard designs, (2) the fabrication and evaluation of prototype equipment, (3) redesign to meet flight-imposed requirements, and (4) qualification and testing of a flight-ready system. Each of these steps is intended to produce the basic design information necessary to progress to the next step. The cost of each step is normally substantially less than that of the following step. An evaluation of the cost elements involved in each of the steps and their impact on total program cost are presented. Cost analyses of four leading oxygen recovery subsystems which include two carbon dioxide reduction subsystem, Sabatier and Bosch, and two water electrolysis subsystems, the solid polymer electrolyte and the circulating KOH electrolyte are described.
Author

N73-27076*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Biotechnology and Power Dept.
COST ANALYSIS OF ATMOSPHERE MONITORING SYSTEMS Final Report
M. M. Yakut Jun. 1973 45 p refs
(Contract NAS8-28377)
(NASA-CR-124306; MDC-G4634) Avail: NTIS HC $4.25 CSCL 06K

A methodology was developed to predict realistic relative cost of life support systems and to define areas of major cost impacts in the development cycle. Emphasis was given to tailoring the cost data for usage by program planners and designers. Cost estimates can be completed using the developed equations for varying degrees of equipment refinement, as well as comparative costs between different functional methods. Cost analysis of two leading atmosphere monitoring systems, namely the mass spectrometer and the gas chromatograph, is discussed. A summary of the approach used in developing the cost estimating techniques is presented. Included are the cost estimating techniques, the development of cost estimating relationships, and the atmosphere monitoring system cost estimates.
Author

N73-27077*# Society of Automotive Engineers, Inc., New York. Bioenvironmental Systems Study Group.
REVIEW AND EVALUATION OF UNIVERSITY GRANT APPLICATIONS FOR LIFE SUPPORT AND CREW EQUIPMENT RESEARCH IN FISCAL YEAR 1974
May 1973 24 p
(Contract NASw-2430)
(NASA-CR-133421) Avail: NTIS HC $3.25 CSCL 06K

Results of a review and technical evaluation of seven research grant applications, related to the field of life support systems and crew equipment technology are presented. The proposals are ranked according to: (1) The technical quality (and promise for effective accomplishment) of the rationale and work plan; and (2) the applicability and priority of importance in terms of NASA's technical interests and requirements in the life support/crew equipment area.
Author

N73-27078*# BioTechnology, Inc., Falls Church, Va.
PROTECTION AGAINST HEARING LOSS IN GENERAL AVIATION OPERATIONS, PHASE 2 Final Report
James F. Parker, Jr. Sep. 1972 26 p refs
(Contract NASw-2265)
(NASA-CR-133303) Avail: NTIS HC $3.50 CSCL 05E

An inflight evaluation of four aural protectors is presented. The hearing protection devices studied were ear muffs, plastic ear plugs, rubber ear plugs, and wax ear plugs. It is concluded that ear plugs are satisfactory for providing adequate sound attenuation in general aviation aircraft. However, two problems were found in the use of ear plugs; comfort and interference with cabin communications.
F.O.S.

N73-27079# Naval Aerospace Medical Research Lab., Pensacola, Fla.
THE USE OF CONFIDENTIAL INSTRUCTOR RATINGS FOR THE PREDICTION OF SUCCESS IN NAVAL UNDERGRADUATE PILOT TRAINING
Wayne L. Waag, Richard H. Shannon, and Rosalie K. Ambler 7 Feb. 1973 19 p refs
(AD-757693; NAMRL-1175) Avail: NTIS HC $3.00 CSCL 05/9

Previous investigations have reported significant relationships between confidential instructor ratings in early primary phase and later success in Naval flight training. Such ratings were found to increase significantly the validities derived solely from selection test scores. However, such findings do not guarantee that confidential ratings would augment the validities derived from the combined array of selection and early training variables which are used in the current student pilot prediction system. The purpose of the present study was to determine whether such confidential ratings provided nonredundant information which would increase the predictive value of the present system. The results clearly indicated that confidential ratings obtained from Primary flight instructors provided information relating to the student's probability of receiving his wings. Such ratings were found to significantly increase the predictive validities derived from the variables which are used currently in the student pilot prediction system. Such findings suggest that these confidential evaluations provide additional information beyond that which is reflected in the grades he assigns. It is recommended that confidential instructor ratings be implemented on a permanent basis in the presolo stage. The present student pilot prediction system should be revised to incorporate this information.
Author (GRA)

N73-27080# Logicon, Inc., San Diego, Calif.
AUTOMATED FLIGHT TRAINING (AFT). INSTRUMENT FLIGHT MANEUVERS Final Report
John P. Charles, Robert M. Johnson, and Jay R. Swink Feb. 1973 94 p refs
(Contract N61339-71-C-0205; NAVTRAEQUIPCEN Proj. 2753-01)
(AD-759366; SDR-113(AFT-I)FR; NAVTRAEQUIPCEN-71-C-0205-1) Avail: NTIS CSCL 05/9

An investigation of the feasibility of applying automated adaptive training methods and techniques to operational flight trainers for basic flight training was conducted. The study explored the on-line restructuring of a computer controlled training course for basic instrument flight maneuvers. Performance evaluation techniques were developed to permit evaluation of student performances in real time. The study uses an R and D simulator and trainees of varied flight experience. A computer controlled voice system was employed for verbal briefings, instructions, and feedback. The results indicated that these techniques can be effectively applied to both initial skill acquisition and proficiency training. The system can identify student skill deficiencies and adapt the training course to meet his training needs.
Author (GRA)

N73-27081# Lear Siegler, Inc., Los Angeles, Calif. Systems Technology Center.
STUDY OF CAPABILITIES, NECESSARY CHARACTERISTICS AND EFFECTIVENESS OF PILOT GROUND TRAINERS. VOLUME 1: MAIN TEXT Final Report, Jul. 1970 - Jun. 1971
Peter Stanek Jan. 1973 260 p refs
(Contract DOT-FA70NA-506)
(AD-755681; STC-16001-Vol-1; FAA-RD-72-127-Vol-1) Avail: NTIS CSCL 05/9

An experiment was conducted to test the capabilities, necessary characteristics, and effectiveness of Pilot Ground Trainers in developing primary aeronautical skills, those maneuvers

and procedures defined in Federal Air Regulations 61.37, 61.87, 61.117 and appropriate Flight Test Guides, limited to aircraft, single-engine, land. During the first phase of the experiment, 30 subjects were trained to proficiency under part 61.87, fifteen in aircraft only and fifteen in combined ground trainer and aircraft. During the next phase, 20 of the original 30 were trained to proficiency under 61.37 and 61.117, 10 in each group. A third phase of the experiment tested additional subjects in various procedures with varying levels of simulator capability. The results of the experiment show which maneuvers and procedures may be taught effectively and efficiently in a ground trainer.
Author (GRA)

N73-27082# California Univ., Santa Barbara. Inst. of Environmental Stress.
PHYSIOLOGICAL PERFORMANCE RELATED TO MULTIPLE STRESSES SUCH AS THOSE EXPERIENCED IN THE AIR FORCE OPERATIONS Final Report
Steven M. Horvath Apr. 1973 7 p refs
(Grant AF-AFOSR-1653-69; AF Proj. 9777)
(AD-759565) Avail: NTIS CSCL 06/19

The basic studies have been concerned with altitude stress, ambient environmental stress, endocrine interrelationships, exercise stress, and the physiological alterations and adjustments to hemorrhagic shock. To determine more adequately psychological and physiological responses new techniques were developed. The most exciting developments involved the determination of catecholamines in nanogram quantities and the measurement of cortisol by a radioimmunological procedure. Much of the value of this research will be forthcoming in studies presently underway where we will have gained additional insight into problems facing men flying with so-called low levels of hypoxic stress. However, adaptive phenomena occur even at these levels and the utilization of this beneficial adjustment to problems of flyers will be of importance. Author (GRA)

06 CHEMISTRY

Includes chemical analysis and identification (e.g. spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N73-27083 National Lending Library for Science and Technology, Boston Spa (England).
THE INTERACTION OF REFRACTORY COMPOUNDS WITH LIQUID ALUMINUM
A. D. Panasyuk Feb. 1973 5 p refs Transl. into ENGLISH from "Fizicheskaya Khimiya Poverkhnostnykh Yavlenii pri Vysokikh Temaeraturakh" Kiev, 1971 p 185-188
(NLL-RTS-7975) Avail: Natl. Lending Library, Boston Spa, Engl.: £0.50; 2 NLL photocopy coupons

A study was made of the stability of some refractory compounds in liquid aluminum at high temperatures. Two procedures, study of the contact angle of wetting by a horizontal drop method and semi-technical trails of heater linings up to temperatures of 1700 C with subsequent metallographic and X-ray diffraction analyses of the products of the interaction, were used for the study. The carbides and borides of metals of the IVA-VIA groups, nitrides of titanium, zirconium, aluminum, and boron carbonitride were used for study. A specially pure aluminum, grade AV0000, purified by zone melting, was also used. Author

N73-27084 Washington Univ., Seattle.
SUBMONOLAYER ISOTOPIC MIXTURES OF HELIUM ADSORBED ON GRAFOIL Ph.D. Thesis
Donald Curtis Hickernell 1972 141 p
Avail: Univ. Microfilms Order No. 73-3724

Submonolayer films of He3-He4 mixtures adsorbed on Grafoil have been studied in the temperature region 0.04 K to 4 K. This work includes four coverages, two of which have been seen to have largely gas like characteristics for the pure isotopes, and the other two of which appear to be strongly influenced by the tendency of the adsorbate to attain a regular structure in registry with the graphite substrate. The low coverage He4 peaks are observed to decrease in temperature and magnitude as the He3 mole fraction is increased, showing a qualitative consistency with lateral condensation theories. Dissert. Abstr.

N73-27085 Stanford Univ., Calif.
PRECIPITATION IN ZINC-DOPED GALLIUM ARSENIDE Ph.D. Thesis
Walden Clark Rhines 1972 239 p
Avail: Univ. Microfilms Order No. 73-4585

Precipitation, caused by the diffusion of zinc into gallium arsenide, was studied with the following objectives: (1) To examine the thermodynamic conditions during diffusion and precipitation, expressed in terms of the gallium-arsenic-zinc ternary phase diagram; (2) to determine the mechanism of precipitate formation; and (3) to study the nucleation, growth, morphology, orientation and distribution of the precipitate, and to correlate these observations with the variables of diffusion temperature, time, source, starting material and quenching rate. Dissert. Abstr.

N73-27086* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROTEIN STERILIZATION METHOD OF FIREFLY LUCIFERASE USING REDUCED PRESSURE AND MOLECULAR SIEVES Patent
Emmett W. Chappelle and Edward Rich, Jr., inventors (to NASA) Issued 10 Jul. 1973 2 p Filed 5 Mar. 1968
(NASA-Case-GSC-10225-1; US-Patent-3,745,089; US-Patent-Appl-SN-710621; US-Patent-Class-195-66R) Avail: US Patent Office CSCL 07D

The sterilization of the protein fruitfly luciferase under conditions that prevent denaturation is examined. Denaturation is prevented by heating the protein in contact with molecular seives and under a reduced pressure of the order of 0.00005 millimeters of mercury.
Official Gazette of the U.S. Patent Office

N73-27087*# Hamilton Standard, Windsor Locks, Conn.
SOLID AMINE DEVELOPMENT PROGRAM
John S. Lovell Apr. 1973 117 p
(Contract NAS9-12957)
(NASA-CR-133963; SVHSER-6185) Avail: NTIS HC $8.00 CSCL 07D

A regenerable solid amine material to perform the functions of humidity control and CO2 removal for space shuttle type vehicle is reported. Both small scale and large scale testing have shown this material to be competitive, especially for the longer shuttle missions. However, it had been observed that the material off-gasses ammonia under certain conditions. This presents two concerns. The first, that the ammonia would contaminate the cabin atmosphere, and second, that the material is degrading with time. An extensive test program has shown HS-C to produce only trace quantities of atmospheric contaminants, and under normal extremes, to have no practical life limitation. Author

N73-27088# National Materials Advisory Board, Washington, D.C.
SUBSTITUTE CATALYSTS FOR PLATINUM IN AUTOMOBILE EMISSION CONTROL DEVICES AND PETROLEUM REFINING Final Report
Mar. 1973 110 p refs
(Contract GS-00-DS-(P)-94008)
(NMAB-297) Avail: NTIS HC $7.50

The technological potential of catalysts other than platinum is assessed as economic and efficient substitutes for platinum in petroleum refining and automobile emission devices for control of atmospheric pollution. Much research is being done to develop base metal under practical conditions in an exhaust environment. More research is necessary in many areas, especially hydrocarbon and carbon monoxide oxidation by oxides and salts with promise of high thermal stability, and nitrogen oxide removal by base metals and their alloys. Author

N73-27089*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CONVERSATIONAL HIGH RESOLUTION MASS SPECTROGRAPHIC DATA REDUCTION
Michael P. Romiez Washington Aug. 1973 41 p refs
(NASA-TM-X-2847; A-4875) Avail: NTIS HC $3.00 CSCL

07D

A FORTRAN 4 program is described which reduces the data obtained from a high resolution mass spectrograph. The program (1) calculates an accurate mass for each line on the photoplate, and (2) assigns elemental compositions to each accurate mass. The program is intended for use in a time-shared computing environment and makes use of the conversational aspects of time-sharing operating systems. Author

N73-27090# Institut fuer Chemie der Treibstoffe, Berghausen (West Germany).

REACTIONS OF UREA WITH CARBOHYDRAZIDE [REAKTIONEN VON HARNSTOFF MIT CARBOHYDRAZID]

W. Engel 30 Nov. 1972 31 p refs In GERMAN

(ICT-5/72) Avail: NTIS HC $3.75

Chemical reactions of urea and carbohydrazide were investigated in smelts and aqueous solutions. Urea and carbohydrazide were converted in molar ratios 1:1, 2:1, and 1:2 in the smelt and in an aqueous solution. The reactions in the smelt up to 140 C lead to carbohydrazide-carboxamide, from 160-180 C to aminourazole. Only in the case of an urea surplus above 160 C, biurea was formed. For the conversions under reflux in aqueous solution, carbohydrazide carboxamide was obtained as the main constituent. ESRO

N73-27091# General Electric Co., Santa Barbara, Calif. DASIAC.

REACTION RATE DATA, NO. 38

Jan. 1973 31 p refs

(Contract DNA001-73-C-0019)

(AD-759847) Avail: NTIS CSCL 07/4

The report presents summaries of recent progress reports and other informal information of current interest in the reaction rate field of interest to the Defense Nuclear Agency. GRA

N73-27092# Rocketdyne, Canoga Park, Calif.

INORGANIC HALOGEN OXIDIZER RESEARCH Annual Report, 1 Apr. 1972 - 31 Mar. 1973

Karl O. Christe, Carl J. Schack, Richard D. Wilson, Earl C. Curtis, and Donald Pilipovich 31 May 1973 207 p refs

(Contract N00014-70-C-0294)

(AD-760696; R-9262) Avail: NTIS CSCL 07/2

The report describes the activities during the past year at Rocketdyne in the area of halogen oxidizer chemistry. A large number of compound types were investigated including halogen perchlorate chemistry, halogen oxyfluoride synthesis, PtF6 chemistry, new fluorination catalysts, novel energetic cation synthesis, halogen oxide chemistry and halogen fluoride reactions. Most of the data have been summarized in manuscript form. A number of papers written during the year are presented in full. The compounds researched include ClF3O2, ClF6(-), ClF5O, ClF, Ozone, Cl2O4, CsIF4. GRA

N73-27093# AeroChem Research Labs., Inc., Princeton, N.J.

KINETICS OF VACUUM ULTRAVIOLET CHEMILUMINESCENCE Final Report

Stanley E. Johnson, Arthur Fontium, and William J. Miller Edwards AFB, Calif. AFRPL Apr. 1973 73 p refs

(Contract F04611-72-C-0013)

(AD-760584; TR-289; AFRPL-TR-73-17) Avail: NTIS CSCL 07/4

Radiation from rocket exhaust plumes in the vacuum ultraviolet (VUV) spectral region (110-180 nm) is of considerable importance to The Air Force and the Defense Research Projects Agency. However, before emission features in a given spectral region can be used by systems, a target model relating radiation intensity to characteristic missle parameters such as fuel type, altitude, area ratio, etc., must be developed. Intensity measurements on the systems of interest are the best source of such a model, but since radiation from foreign missiles generally cannot be measured under controlled conditions, theoretical means using laboratory results must be employed. As part of such an approach, the authors have identified the radiation, and determined the mechanism leading to emission, from a number of laboratory mixtures corresponding to major reactant compositions found in plumes of hydrocarbon- and amine-fueled rockets. These laboratory reaction systems are atomic O/C2H2 and atomic O/atomic N/C-compound mixtures in a fast-flow tube reactor at 300 K and 0.8 to 10 torr and self-sustaining flames of various hydrocarbon and amine fuels with O2 and N2O4 at 1700-2200 K and 0.8 - 20 torr. (Author Modified Abstract) GRA

N73-27094# Physical Dynamics, Inc., Detroit, Mich.

HYDROCARBON CHEMISTRY AND CHEMILUMINESCENCE IN HIGH ALTITUDE PLUMES

R. H. Kummler, E. R. Fisher, and F. P. Boynton Apr. 1973 75 p refs Revised

(Contracts F19628-72-C-0006; ARPA Order 1856; AF Proj. 8692)

(AD-760793; PD-72-031; AFCRL-TR-73-0078; SR-2) Avail: NTIS CSCL 07/4

A plausible simplified mechanism for the oxidation of hydrocarbons under conditions germane to high altitude plumes has been outlined. It was found that in the low pressure, high oxygen atom environment above 100 km, a sequence of bimolecular reactions leading to both IR and UV light emission can be initiated by the oxygen atom attack on secondary hydrogens in saturated hydrocarbons containing more than three carbon atoms as well as by O and OH attack on the unsaturated hydrocarbons which may be present initially or produced in the sequence. A specific set of prototype reactions with rate constants is recommended for the basic chemistry on the basis of an extensive review of the current literature; a model is provided for IR chemiluminescence which follows the main mechanism; and a UV perturbation mechanism based upon the presence of acetylene is suggested. (Author Modified Abstract) GRA

N73-27095# Army Electronics Command, Fort Monmouth, N.J.

FREEZING WATER WITH SIZED AgI PARTICLES. PART 2: THEORETICAL CONSIDERATIONS

Hermann E. Gerber Mar. 1973 35 p refs

(DA Proj. 1T0-61102-B-53A)

(AD-758858; ECOM-5478-Pt-2) Avail: NTIS CSCL 07/4

Following Fletcher's technique, expressions are developed for the heterogeneous nucleation rate of supercooled water droplets by thermally generated AgI particles. The rate equations are determined as a function of the AgI particle size, shape, and surface structure, critical embryo shape, temperature, and ice-AgI contact angle in water. The assumptions and approximations inherent in this treatment are evaluated. It was determined that the important assumption of an appreciable nucleation rate is inconsistent with the large uncertainty in the value of the contact angle. As a consequence, classical theory could account for the experimentally determined dependence of activity on the particles: surface area. The appreciable nucleation rate also may not be used in Fletcher's ice-filled pits site theory. It is shown how the statistical nature of the nucleation process provides a method by which classical and site theory may be differentiated. Author (GRA)

N73-27096*# Cornell Univ., Ithaca, N.Y. Materials Science Center.

LINE STRENGTHS AND RADIATIVE LIFETIMES FOR Ne 2

D. Hodges, H. Marantz, and G. L. Tang 1973 25 p refs Sponsored in part by NASA and ARPA

(NASA-CR-133406; AD-759054) Avail: NTIS HC $3.25 CSCL 07/4

Extensive spontaneous emission data on Ne II has been obtained using a CW neon laser discharge as the spectroscopic source. The measured branching ratios are used to evaluate the accuracies of previous determinations of Ne II 3p-3s and 3d-3p line strengths. The results show that some of the previously tabulated line strength values are clearly in need of revision. New determinations of the line strengths for the Ne II 3p-3s, 3d-3p, and 4s-3p transitions are given. Calculated radiative lifetimes of various Ne II 3s, 3p, 3d, and 4s states are also given and compared with the published experimental lifetimes for a few of the 3p and 4s states of Ne II. Author (GRA)

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N73-27097 Illinois Inst. of Tech., Chicago.
GENERALIZED RADAR EQUATIONS AND DOPPLER SHIFT IN THE FRESNEL REGION Ph.D. Thesis
Alfred Gerard Holtum 1972 67 p
Avail: Univ. Microfilms Order No. 73-3625

An analysis of the Doppler return from single and multiple targets in the Fresnel region is reported, as well as simplified generalized radar equations which can be easily applied to modern radar measurements, including radar meteorology, for making possible the quantitative interpretation of results of radar measurements made in the Fresnel region. Dissert. Abstr.

N73-27098 Ohio State Univ., Columbus.
ANALYSIS OF ON-AIRCRAFT ANTENNA PATTERNS Ph.D. Thesis
Walter Dennis Burnside 1972, 217 p
Avail: Univ. Microfilms Order No. 73-1957

The radiation patterns of on-aircraft antennas are analyzed using high frequency solutions. This is a basic study of aircraft-antenna pattern performance in which the analytic aircraft is modelled in its most basic form. The fuselage is assumed to be a perfectly conducting convex surface. The wings are simulated by arbitrarily many sided flat plates and the jet engines are treated as finite circular cylinders. The three principal plane patterns are analyzed in great detail with measured results taken to verify each solution. A volumetric pattern study is initiated with the fuselage modelled by an arbitrary convex surface of revolution. Dissert. Abstr.

N73-27099 Japan Broadcasting Corp., Tokyo.
EXPERIMENTAL TRANSMISSION SYSTEM OF STILL PICTURE BROADCASTING
Heiichiro Ando, Hisakichi Yamane, and Eiichi Sawabe Feb. 1973 15 p refs
(NHK-Labs-Note-158) Copyright. Avail: Issuing Activity

A cable system for still picture transmission by television is enlarged in order to broadcast sound together with these pictures. The signal waveform of still picture broadcasting has not the amplitude separable sync signal that is used in ordinary television; PCM digital sync signals are transmitted even in the picture mode period to attain synchronization of PCM signals in the picture period and of the sound signals in the sound periods. G.G.

N73-27100 Stanford Univ., Calif.
GROUND THERMAL OPTIMIZATION AND SYSTEM COST/PERFORMANCE ANALYSIS FOR SATELLITE TV BROADCASTING Ph.D. Thesis
Katsuhiko Ohkubo 1972 161 p
Avail: Univ. Microfilms Order No. 73-4568

This dissertation discusses the technical and economical feasibility of the 12 GHz band for the broadcasting satellites. Among the three frequency bands assigned for the boradcasting satellites, the 12 GHz band gives the most channels and the least interference on and from the terrestrial, communication links but it has difficulties in achieving low cost mass-producible ground terminal receivers and encounters a considerable amount of signal attenuation due to rain. The system design and analysis are carried out on the basis of a decision analysis model throughout the paper. Technical difficulties in achieving low cost 12 GHz receivers are solved by making use of a die cast aluminum packaging, a hybrid integrated circuit mixer, a cavity stabilized Gunn oscillator and other state of the art microwave technologies for the receiver frontend. Working models are designed and tested. Dissert. Abstr.

N73-27101 Auburn Univ., Ala.
DETERMINATION OF CONTOURS OF PICTURE QUALITY FOR SATELLITE TELEVISION BROADCASTING SYSTEMS Ph.D. Thesis
Sajjan Gangappa Chandrasekharaiah 1972 108 p
Avail: Univ. Microfilms Order No. 73-1900

The Television Broadcast Satellite (TVBS) has the greatest potential for directly helping the peoples of the world. Extremely careful planning is needed in the design of these systems, because of the high initial cost involved. The space frequencies that are allocated for broadcasting are in the 2.5 GHz and 12 GHz range. Though ionospheric effects are negligible at these frequencies, tropospheric effects become important, especially at 12 GHz. Further, these effects are highly weather dependent and statistical analysis is needed for an optimum system design. Hence by using climatological data for one year and for different locations in the U.S., the time and location probability data of the atmospheric attenuation and sky noise temperature have been determined. Dissert. Abstr.

N73-27102 Tulane Univ., New Orleans, La.
ON WAVE PROPAGATION IN A BONDED BI-LAYERED PIEZOELECTRIC SYSTEM Ph.D. Thesis
Joel Charles Axt 1973 109 p
Avail: Univ. Microfilms Order No. 73-2181

Some aspects of wave propagation in a double-layered piezoelectric system were analyzed. The piezoelectric system consisted of two crystals (CdSe and CdS) with the same crystal symmetry. The two media were bonded by a non-piezoelectric material of negligible thickness and subject to the following boundary conditions. At the upper and lower bounding surfaces, the stresses were assumed to be zero, i.e., traction-free. At the bonded interface, three conditions of continuity were imposed: (1) mechanical displacement, (2) normal components of the electrical displacement, and (3) the tangential components of the electric field. Using the piezoelectric equations and Maxwell's field equations, solutions were obtained for two cases of wave propagation: (1) normal, and (2) parallel to the bonded interface. The wave solutions were numerically evaluated and graphs were plotted. Dissert. Abstr.

N73-27103# Tokyo Univ. (Japan).
RECEPTION CHARACTERISTICS OF MONOPOLE ANTENNAS FOR ELECTRON PLASMA WAVES,
Yoshiharu Nakamura, Masahara Nakamura, and Tomizo Itoh May 1973 14 p refs
(ISAS-491) Avail: NTIS HC $3.00

The radiation patterns of a longitudinal electron wave excited in a warm plasma by parallel plane grids and the reception patterns of wire antenna were measured experimentally, and the results agreed with the theoretically predicted radiation pattern. The reception patterns of a gridded parallel plate antenna are sharper than the theoretical radiation pattern and the sharpness depended on width of its guard ring. The dependence of the received amplitude on the dc potential of the antennas was studied. The possibility of estimating the wavelength from measured amplitudes is also discussed. Author

N73-27104# Federal Aviation Administration, Washington, D.C. Office of Systems Engineering Management.
ENGINEERING AND DEVELOPMENT PROGRAM PLAN: SATELLITE EXPERIMENTATION
Mar. 1973 52 p refs
(FAA-ED-17-1) Avail: NTIS HC $4.75 CSCL 17B

The application of space technology to air traffic control is considered. The planning, development, engineering, experimentation, and evaluation of an aeronautical satellite communication capability over the Atlantic Ocean is outlined and the development and design data and techniques through analysis and experimentation is described. Author

N73-27105# Lockheed Missiles and Space Co., Palo Alto, Calif.
SOME PECULIARITIES IN MEASURING THE ANGLE OF ROTATION OF THE POLARIZATION PLANE OF INCOHERENTLY SCATTERED IONOSPHERE RADIO SIGNALS
G. N. Tkachev, V. M. Lazarenko, N. V. Moshniakov, and V. T. Rozumenko [1973] 4 p refs Transl. into ENGLISH from Radiotekhn. i Elektron. (Moscow), v. 18, no. 5, 1973 p 1051-1053

Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The depolarization influence of the scattering volume is considered in measuring the angle of rotation of the polarization plane of radio signals scattered by thermal fluctuations of the ionosphere electron concentration. It is shown that the signal power received by mutually orthogonal linearly polarized antennas is related to the angle of rotation of the polarization plane of the wave being propagated from the radar to the center of the scattering volume and back. The degree of polarization fading is determined by the magnitude of the correlation coefficient between the ordinary and extraordinary components of the scattered signal field. G.G.

N73-27106*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

SYSTEM FOR INTERFERENCE SIGNAL NULLING BY POLARIZATION ADJUSTMENT Patent Application

John E. Ohlson and William F. Williams, inventors (to NASA) Filed 28 Jun. 1973 18 p

(Contract NAS7-100)

(NASA-Case-NPO-13140-1; US-Patent-Appl-SN-374422) Avail: NTIS HC $3.00 CSCL 17B

A receiving system for automatically selecting a desired one of two approximately orthogonally polarized signals occupying the same bandwidth, is disclosed. Received signals are provided by any orthomode antenna system at a pair of output ports, i.e., right hand and left hand circular polarizations or two linear polarizations. The received signals are then applied to the inputs of a hybrid junction to produce sum and difference signals. The resulting sum signal at one output port comprises components of the undesired one of two orthogonally polarized signals and is used to coherently detect and dynamically balance out the undesired signal components that are included at the difference signal port. The desired one of two orthogonally polarized signals is thereby provided at the difference port of the hybrid junction. Feedback loops are used to effect dynamic balancing. NASA

N73-27107*# Bell Aerospace Co., Buffalo, N.Y.

MODULATOR FOR TONE AND BINARY SIGNALS Patent Application

James R. McChesney, Theodore Lerner, and Ernest J. Fitch, inventors (to NASA) Filed 15 Jun. 1973 18 p Sponsored by NASA

(NASA-Case-GSC-11743-1; US-Patent-Appl-SN-370271) Avail: NTIS HC $3.00 CSCL 17B

Tones and binary information are transmitted as phase variations on a carrier wave of constant amplitude and frequency. The carrier and tones are applied to a balanced modulator for deriving an output signal including only a pair of sidebands relative to the carrier, which has a predetermined phase. The carrier is phase modulated by a digital signal so that it is + or - 90 deg out of phase with the predetermined phase of the carrier. The carrier, in unmodulated form at the predetermined phase, is combined in an algebraic summing device with the phase modulated signal and the balanced modulator output signal. The output of the algebraic summing device is hard limited to derive the constant amplitude and frequency signal. At a receiver, the tones and binary data are detected with a phase locked loop having a voltage controlled oscillator driving a pair of orthogonal detection channels. NASA

N73-27108# Joint Publications Research Service, Arlington, Va.

RADARS WITH SYNTHESIZED ANTENNA

N. I. Burenin 29 Jun. 1973 149 p refs Transl. into ENGLISH of the book "Radiolokatsionnyye Stantsii s Sintezirovannoy Antennoy" Moscow, Sov. Radio, 1972 160 p

(JPRS-59391) Avail: NTIS HC $9.50

The theory of coherent side-looking radar designed to obtain a detailed radar image of the earth's surface from aircraft and spacecraft is presented. Author

N73-27109*# ESL, Inc., Sunnyvale, Calif. Electromagnetic Systems Labs.

A ROUGH EARTH SCATTERING MODEL FOR MULTIPATH PREDICTION Progress Report

L. J. Page and P. C. Chestnut 24 Jun. 1970 42 p refs

(Contract NAS5-20125)

(NASA-CR-132791; ESL-PR53) Avail: NTIS HC $4.25 CSCL 17B

The most important phenomena to be considered in a model of radio wave communication between earth satellites are scattering from the surface of the earth. A model is derived and implemented on a computer to predict the field received after reflection from a rough, spherical earth. The scattering integrals are computed numerically; the domain of integration is the appropriate region on the surface of the earth. Calculations have been performed at VHF frequencies and for terrain which could be described as marshy land. Rough surface scattering calculations must be performed over a spherical earth when satellites are involved. There is a definite dependence on the values of the roughness, and the correlation length. Author

N73-27110*# Ohio State Univ., Columbus. ElectroScience Lab.

THE RADIATION FROM APERTURES IN CURVED SURFACES

P. H. Pathak and R. G. Kouyoumjian Washington NASA Jul. 1973 79 p refs

(Grant NGR-36-008-144)

(NASA-CR-2263) Avail: NTIS HC $3.00 CSCL 17B

The geometrical theory of diffraction is extended to treat the radiation from apertures or slots in convex, perfectly-conducting surfaces. It is assumed that the tangential electric field in the aperture is known so that an equivalent, infinitesimal source can be defined at each point in the aperture. Surface rays emanate from this source which is a caustic of the ray system. A launching coefficient is introduced to describe the excitation of the surface ray modes. If the field radiated from the surface is desired, the ordinary diffraction coefficients are used to determine the field of the rays shed tangentially from the surface rays. The field of the surface ray modes is not the field on the surface; hence if the mutual coupling between slots is of interest, a second coefficient related to the launching coefficient must be employed. In the region adjacent to the shadow boundary, the component of the field directly radiated from the source is presented by Fock-type functions. In the illuminated region the incident radiation from the source (this does not include the diffracted field components) is treated by geometrical optics. This extension of the geometrical theory of diffraction is applied to calculate the radiation from slots on elliptic cylinders, spheres and spheroids. Author

N73-27111# Institute for Telecommunication Sciences, Boulder, Colo.

POWER SPECTRA OF COMPUTER SIMULATED FREQUENCY MODULATION WITH DIGITAL MSK AND VOICE INPUT Final Report, Feb. 1972 - Mar. 1973

E. J. Dutton and J. R. Juroshek Mar. 1973 74 p refs

(Contract DOT-FA72WAI-268)

(FAA-RD-73-56) Avail: NTIS HC $5.75

A FORTRAN computer program, FMSPECT, which obtains the power spectrum of an FM signal, modulated by a voice signal, a digital signal, and combinations of both is presented. The theory behind the simulation of the voice signal 265-5575 Hz) is described, as well as the theory of simulating an MSK digital signal (2400 bits-per-second). The digital signal is multiplexed onto the voice at 7200 Hz for combined transmission. Sample spectra are shown for various modulation conditions, and the results are presented in the form of graphs and tables. A listing of the program is given in the appendix. Author

N73-27112# Japan Broadcasting Corp., Tokyo.

THERMOMAGNETIC ANALOG RECORDING

Tatsuo Nomura and Katsuya Yokoyama Jan. 1973 7 p refs

(NHK-Labs-Note-157) Copyright. Avail: NTIS HC $3.00

The thermomagnetic recording of an analog signal on a CrO2 magnetic tape using a conventional magnetic head and a laser beam as a heating source, is discussed. It was concluded from experimental results that the method can be used for fairly high density analog recording. Specifically, track widths of about 20 microns, and wavelengths of about 12 microns can be used.

Author

N73-27113# Australian Post Office Research Labs., Melbourne.
SIMULATION TESTING OF A NEW DIGITAL DETECTION SCHEME FOR DIGITALLY-ENCODED MULTIFREQUENCY TONES
M. A. Wilson Jan. 1973 27 p refs
(Rept-6755) Avail: NTIS HC $3.50

The simulation testing of the Proudfoot detection scheme for digitally encoded multifrequency tones is described in two applications: the recognition of (1) voice frequency push button tones from a subscribers handset; and (2) inter-exchange multifrequency coded signals. In both cases the detection scheme was found to satisfy the requirements of the specifications for these receivers. Author

N73-27114# Institute for Telecommunication Sciences, Boulder, Colo. Office of Telecommunication Sciences.
ELECTROSPACE PLANNING AND ENGINEERING FOR THE TRAFFIC ENVIRONMENT Final report
G. D. Gierhart, R. W. Hubbard, and D. V. Glen Dec. 1970 304 p refs
(Contract DOT-FA67WAI-134)
(FAA-RD-70-71) Avail: NTIS HC $17.25

Service limitations imposed upon VHF/UHF/SHF radio communication links by cochannel and adjacent-channel interference is the primary subject, but limitations imposed by intermodulation and noise are also discussed. Methods for predicting available desired-to-undesired signal ratios (protection ratio) and determining the required protection ratio are summarized. Appendices on frequency sharing with air traffic control satellite, modulation characteristics, and system performance measurements are included. Author

N73-27115*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VANGUARD/PLACE EXPERIMENT SYSTEM DESIGN AND TEST PLAN
Ralph E. Taylor Apr. 1973 86 p refs
(NASA-TM-X-66287; X-752-73-117) Avail: NTIS HC $6.50

The design, development, and testing of the NASA-GFSC Position Location and Aircraft Communications Equipment (PLACE) at C band frequency are discussed. The equipment was installed on the USNS Vanguard. The tests involved a sea test to evalute the position-location, 2-way voice, and 2-way data communications capability of PLACE and a trilateration test to position-fix the ATS-5 satellite using the PLACE system. Author

N73-27116# Lockheed Missiles and Space Co., Palo Alto, Calif.
ELECTROMAGNETIC WAVE DIFFRACTION BY A FINITE PLANE-PARALLEL WAVEGUIDE SYSTEM
Ia. N. Feld and G. A. Svistunov [1973] 12 p refs Transl. into ENGLISH from Radiotekhn. i Elektr. (Moscow), v. 18, no. 4, 1973 p 897-908
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

Electromagnetic wave diffraction by a finite plane-parallel waveguide system is discussed. The problem is solved through a system of two integral equations which use the method of special orthogonalization and the generalized method of magnetomotive forces. Phase correctors which alter the phase of the wave being propagated are disposed at the middle of the waveguide sections. Results of the numerical analyses of the field distributions in the waveguide apertures, the standing wave coefficients, the directivity patterns, the efficiency, and the transmission coefficient are presented. Author

N73-27117# Lockheed Missiles and Space Co., Palo Alto, Calif.
PECULIARITIES OF SIDE SCANNING FROM ARTIFICIAL EARTH SATELLITES
N. I. Burenin [1973] 11 p refs Transl. into ENGLISH from the book "Radiolokatsionnye Stantsii s Sintezirovannoi" Antennoi Moscow, Sov. Radio p 145-159
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

The application of pulsed radars for side scanning from artificial earth satellites is discussed. The characteristics conditions under which side scanning is realized from orbiting vehicles are described. Mathematical models of radar performance are developed. It is stated that the radar information obtained by a side-scan radar station can be processed directly on the satellite or can be transmitted in unprocessed form to the ground processing station. Author

N73-27118*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO 17 MISSION ANOMALY REPORT NO. 1: ERRONEOUS MEASUREMENTS TRANSMITTED BY TELEMETRY
May 1973 14 p
(NASA-TM-X-69367; JSC-07985) Avail: NTIS HC $3.00 CSCL 09F

Results are presented of analyses conducted to determine why erroneous data were transmitted by 60 of the 1 sample-per-second telemetry channels of Apollo 17 for a 2-minute period beginning at about 191 hours 40 minutes. Reasons for the failure and corrective actions taken are described. A.L

N73-27119# Marconi Co., Ltd., Chelmsford (England). Radio Div.
STUDY OF FM-TV IMPAIRMENTS IN A RECEIVER OPERATING NEAR THRESHOLD AND IN BAND-LIMITING CONDITIONS Final Report
Jan. 1973 128 p Original contains color illustrations
(Contract ESTEC-1664-72-EL)
(ESRO-CR(P)-251) Avail: NTIS HC $8.50

An experimental system was set up to represent the down-link of a possible direct satellite TV broadcasting system. The performance of the system operating near threshold and in conditions of band-limiting was investigated. Subjective system performance was assessed with a color bar signal and the results were photographed. These tests were backed up with objective, waveform, and noise measurements. It appears that the sound subcarrier's level must be considered in any system tradeoffs which are made. The color bar signal was found suitable for detecting the presence of fine interference patterns, although the lack of fine detail in the picture itself probably increased the observer's tolerance towards noise impairments. The simple 24 MHz and 32 MHz IF filters gave results which appeared scaled to the filter bandwidths. ESRO

N73-27120# Marconi Co., Ltd., Chelmsford (England). Space Div.
STUDY OF FM-TV IMPAIRMENTS IN A RECEIVER OPERATING NEAR THRESHOLD AND IN BAND-LIMITING CONDITIONS Addendum to Final Report
Apr. 1973 82 p Original contains color illustrations
(Contract ESTEC-1664-72-EL)
(ESRO-CR(P)-252) Avail: NTIS HC $6.25

An experimental system was set up to represent the down-link of a possible direct satellite TV broadcasting system. The performance of the system operating near threshold and in conditions of band-limiting was investigated. Subjective system performance was assessed with a color bar signal and the results were photographed. These tests were backed up with objective, waveform, and noise measurements. The bandwidth of the IF filter was reduced to 20 MHz, and the results were compared with 24 and 32 MHz filters. Experimental expressions are presented for the system conditions at which interference from the sound channel becomes perceptible in the video. ESRO

N73-27121# European Space Research and Technology Center, Noordwijk (Netherlands).
PARAMETRIC STUDY OF A MARITIME SATELLITE SYSTEM
A. A. Steciw Mar. 1973 4 p Presented at the Intern. Conf. on Satellite Systems for Mobile Commun. and Surveillance, London, 13-15 Mar. 1973
Avail: NTIS HC $3.00

The results of a parametric study of a maritime satellite system using conventional broad beam and multibeam dish antennas for links between ships and satellite are summarized. The parametric study is based on the following approach: starting from the mass, power, and dimension limitations of a relatively light and low cost launcher with geostationary capability (up-rate

Thor Delta 2914), it assesses the number of communication channels achievable for a maritime satellite system as a function of the channel quality and the ship terminal antenna gain. The communication capability is assessed assuming frequency division multiple access. Author (ESRO)

N73-27122# Kiruna Geophysical Observatory (Sweden).
FIXED FREQUENCY IONOSONDE RECEIVER WITH A PHASE SWEPT INTERFEROMETER
Sixten Olsson and Ludwik Liszka Apr. 1972 23 p refs
(KGO-726) Avail: NTIS HC $3.25

A fixed frequency ionosonde receiver incorporating a phase swept interferometer is described. The interferometer operates at intermediate frequency of 455 kHz of two identical receivers R-390 with common local oscillators. A dual film recorded pattern from the pulses reflected from the ionosphere from a fixed frequency ionosonde transmitter at MHz of conventional type is obtained as follows: two antennas of known separation and cable lengths receive signal pulses reflected from the ionosphere. After passing the antenna gates, where the ground pulse is removed, an appropriate interval of virtual height range for investigation is chosen, and the antenna switching between NS and EW is accomplished. The signals are passed to two receivers with common local oscillators. One of the IF signals from the receivers is directly passed over to the phase comparator while the other IF signal to the phase comparator passes a continuous phase sweep before phase comparison takes place. ESRO

N73-27123# Illinois Univ., Urbana. Dept. of Civil Engineering.
GEOMETRIC ANALYSIS OF THE RBV TELEVISION SYSTEM, PHASE 2 Final Report, 16 Jun. 1971 - 15 Sep. 1972
Kam W. Wong 15 Sep. 1972 76 p refs
(Contract DI-14-08-0001-12631)
(PB-218393/7; UILU-ENG-72-2016; USGS-DO-73-006; Ser-35) Avail: NTIS HC $3.00 CSCL 17B

The geometric distortion characteristics and calibration problems of the return-beam vidicon (RBV) television systems being used in the Earth Resources Technology Satellites (ERTS) program was discussed. The overall objectives of this project are:(1) to establish the magnitude, pattern, and stability of geometric distortions in the RBV systems;(2) to devise procedures and data reduction methods for the accurate calibration of the system internal geometry; and (3) to provide accurate distortion and calibration data for detailed analysis of the potential mapping accuracy of the RBV images. GRA

N73-27124# Office of Telecommunications Policy, Washington, D.C.
CONFERENCE ON COMMUNICATIONS POLICY RESEARCH: PAPERS AND PROCEEDINGS
18 Nov. 1972 333 p refs Conf., held at Washington, D. C., 17-18 Nov. 1972
(PB-218981/9; OTP-SP-11) Avail: NTIS HC $9.00 CSCL 17B

Contents: some preliminary thoughts on subsidization; on subsidization-some observations and tentative conclusions; publicly owned versus privately owned utilities-a public choice; spectrum allocation and regulatory incentives; studies in the economics of mass communication; decentralization of public television; democracy in the newsroom and the FCC; the economics of cable television consensus; cable television as a common carrier; and the role of analysis in the formation of cable policy. GRA

N73-27125# Little (Arthur D.), Inc., Cambridge, Mass.
ELECTROMAGNETIC AND SEISMIC NOISE AND PROPAGATION
Mar. 1972 67 p refs
(Contract DI-BM-HO-122026)
(PB-217500/8; ADL-C-73912; OFR-12-73) Avail: NTIS HC $3.00 CSCL 20N

A partial Bibliography of the literature concerning electromagnetic and seismic noise and propagation has been complied as a result of an abbreviated literature search. The reference sources include the open literature, in-house reference files, and Bureau of Mines contractor reports. The references are organized by major subject categories and arranged alphabetically by author within each subject category. Examination of the bibliography will reveal references that cover frequency bands higher than that of original interest for coal mine emergency communications. Some high frequency references to EM noise and mobile communication systems have been included in order to better serve the presently wider needs and plans of the Bureau of Mines with respect to the improvement of coal mine operational/emergency communications. GRA

N73-27126# Defense Documentation Center, Alexandria, Va.
RADOMES Report Bibliography, May 1958 - Dec. 1972
Jun. 1973 174 p refs
(AD-760960; DDC-TAS-73-33) Avail: NTIS CSCL 17/9

The bibliography contains unclassified and unlimited reports on Radomes. These references express the use of composite materials, ceramic materials, textiles, and plastics in Radomes. Discussed are design, construction, manufacturing methods, stresses, wave transmission, and performance evaluation of radomes. Author (GRA)

N73-27127# General Electric Co., Syracuse, N.Y. Electronics Lab.
DUAL BAND VARI-POLARIZATION BEACON ANTENNA Final Technical Report, Mar. 1972 - Feb. 1973
Joseph A. Kinzel Apr. 1973 136 p refs
(Contract F30602-72-C-0296)
(AD-760816; RADC-TR-73-102) Avail: NTIS CSCL 17/9

The report describes the work performed to confirm the feasibility of integrating a Ku-band radiator with an existing X-band antenna design and to provide the dual band capability with an increase in bandwidth to 6 percent. Pattern coverage was to be omnidirectional in azimuth and to extend from 0 to 60 degrees in elevation with a -1 db gain. (Author Modified Abstract) GRA

N73-27128# Army Missile Command, Redstone Arsenal, Ala. Advanced Sensors Directorate.
IMPROVED MOVING-TARGET-INDICATOR FILTERING FOR PHASED ARRAY RADARS
Robert H. Fletcher, Jr. and Donald W. Burlace 28 Mar. 1973 22 p refs
(DA Proj. 1M2-62303-A-214)
(AD-759901; RE-73-17) Avail: NTIS CSCL 17/9

A technique is described for using recursive digital filters in the moving target indicator of phased array radars. This technique, called initialization, is effective in reducing the severe transient effects normally exhibited by these filters for large clutter input signals. Consequently, the superior frequency characteristic of recursive filters can be realized. The problem is addressed from the state variable point of view and a general initialization expression is derived. This procedure is illustrated for example filters, and typical moving target indicator output sequences are shown. The concept of dynamic frequency response is introduced and used to demonstrate the effectiveness of initialization for moving target indicator input sequences of varying length. Author (GRA)

N73-27129# Yale Univ., New Haven, Conn. Dept. of Administrative Sciences.
INTERACTIVE MAN-MACHINE COMMUNICATION Annual Report, 1 Feb. 1972 - 31 Jan. 1973
James H. Carlisle and Robert B. Fetter Mar. 1973 70 p refs
(Contract N00014-67-A-0097-0010; NR Proj. 049-293)
(AD-760010; TR-66) Avail: NTIS CSCL 17/2

To demonstrate that, for users with varying psychological characteristics, alternative modes of man-computer dialogue should be provided for a given task, an experimental design has been formulated. The research on specific hypotheses involves conceptual complexity and environmental complexity. To facilitate the design of alternative modes of man-computer dialogue, a technique of protocol analysis for information system design is adapted from that used in artificial intelligence research. A description of this new technique is included. Two papers outline some of the objectives and methodologies currently in use. GRA

N73-27130# Naval Electronics Lab. Center, San Diego, Calif.
A D-REGION MODEL WHICH ACCOUNTS FOR QUIET AND

DISTURBED VLF PROPAGATION PHENOMENA Research Report, Jul. 1972 - Jan. 1973
M. P. Bleiweiss, V. E. Hildebrand, and J. R. Hill 30 Mar. 1973 30 p refs
(NELC Proj. M207)
(AD-760685; NELC-TR-1868) Avail: NTIS CSCL 04/1

The Employment Service has become a vital part of the national manpower development program, but knowledge of the Service is essential if national manpower policies are to be fully understood. Data were gathered from literature research and informal discussions with Department of Labor personnel in Washington, D.C. The Employment Service is examined from a historical viewpoint, and current operations, including strengths and weaknesses, are scrutinized. It is concluded that positive corrective action should be taken by the federal government in several areas. GRA

N73-27131# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ERROR REDUCTION IN A TWO-GIMBAL, AIRBORNE, ANGLE TRACK SYSTEM M.S. Thesis
George L. Wright Mar. 1973 78 p refs
(AD-760551; GE/EE/73-25) Avail: NTIS CSCL 17/9

Angle measurement in a two-gimbal, airborne, tracking system is complicated by the motion of the aircraft. The two-gimbal system is characterized by the azimuth and elevation channel control systems. Rolling motions introduce error-causing disturbance inputs into each channel. One method of reducing the error investigated in this report is a linear transformation method which treats both channels simultaneously by considering a cross-coupled multivariable system. Another method, the invariance method, utilizes a feed forward branch whose input is the unwanted disturbance to reduce the error due to aircraft roll rate for each channel separately. (Author Modified Abstract) GRA

N73-27132# Naval Electronics Lab. Center, San Diego, Calif.
ELF ATTENUATION RATES REDUCED FROM SFERICS MEASUREMENTS. SAMPLE RECORDINGS AND ATTENUATION RATES FOR DAYTIME AND NIGHTTIME PROPAGATION Research and Development Report, Jul. - Dec. 1972
J. N. Martin 9 Apr. 1973 30 p refs
(AD-760686; NELC-TR-1871) Avail: NTIS CSCL 04/1

Instrumentation has been developed at NELC for digitally recording sferic waveforms in the ELF and VLF bands. Accurage timing and direction-of-arrival information is provided to allow identification of signals at widely separated receiving sites. If signals propagating in a single mode over a common great-circle path are received at two locations, the attenuation rate can be determined from differences in the amplitude spectra of the signals. In July 1972, three of the sferics recorders were operated to obtain data for sferics originating in Colorado and received in California and Hawaii. The equipment is described, and derived daytime and nighttime attenuation rates in the ELF band are presented. Author (GRA)

N73-27133# Naval Undersea Center, San Diego, Calif.
APPROXIMATE ARRAY GAIN EXPRESSIONS FOR VERTICALLY DIRECTIVE NOISE Research and Development Report, Jul. - Nov. 1972
George W. Benthien and Charles S. Nichols Apr. 1973 46 p refs
(SF11121304)
(AD-760690; NUC-TP-341) Avail: NTIS CSCL 17/1

Array gains of linear and rectangular arrays were calculated by summation of spatial-correlation coefficient over all pairs of array elements for a noise model consisting of a uniform distribution of dipoles on the surface of the sea. Approximate expressions for these array gains were derived for the same noise model. Calculated and approximate array gains were found to agree closely so long as the interelement spacing was not too small and there were no secondary major lobes. Calculated and approximate array gains for the surface dipole noise model were compared to those obtained for an isotropic noise model and were found to differ from them by as much as 10 db, showing that the array gain is very sensitive to the type of noise environment in which the array is located. GRA

N73-27134# Naval Undersea Center, San Diego, Calif.
BEARING-OF-ARRIVAL ESTIMATES FOR TRANSIENT SIGNALS Research and Development Report, Jun. 1971 - Jun. 1972
O. D. Grace Apr. 1973 45 p
(AD-760691; NUC-TP-342) Avail: NTIS CSCL 17/1

The report theoretically and experimentally investigates three techniques for estimating the bearing of arrival of transient signals. These techniques estimate bearing of arrival from the differences between signal arrival times at the array elements, as measured by envelope delays and cross-correlation delays; the differences between signal amplitudes at the array elements; and a simultaneous bearing search by a steerable beam. Theoretical expressions for statistical bias and error range of each technique are developed, and these results are compared with corresponding experimental results that were obtained using data collected at sea. Author (GRA)

N73-27135# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
APPLICATION OF FINITE ELEMENT ANALYSIS TO COPLANAR WAVEGUIDE M.S. Thesis
Arnold C. Celestini Mar. 1973 82 p refs
(AD-760756; GE/EE/73-4) Avail: NTIS CSCL 20/14

An accurate method of calculating the transmission line characteristics of coplanar waveguide is required for design considerations. In his conformal mapping approach, C.P. Wen assumed the dielectric was infinitely thick and employed a quasi-static approximation. Wen's approach was modified by taking into account the finite thickness of the substrate and the resulting calculations were very accurate. With these calculations to use as a standard, the primary investigation was shifted to applying finite element analysis in the form of two computer programs to the coplanar waveguide problem. The two programs were modified to make them compatible with one another and permit their operation on the CDC 6600 computer. A solution to Laplace's equation resulted in the production of equipotential plots which were analyzed using a field mapping technique. (Author Modified Abstract) GRA

N73-27136# Signals Research and Development Establishment, Christchurch (England).
A SIMULATION OF A COMPLEX MICROELECTRONIC MODULE CONTAINING ANALOGUE AND DIGITAL ELEMENTS
C. H. Jones Oct. 1972 33 p refs
(AD-761206; SRDE-72027; BR34195) Avail: NTIS CSCL 17/2

The report describes an attempt to simulate the complex functions present in a Delta Sigma Speech Coder based on the G.E.C. Mk 3 coder. The simulation is flexible allowing parameters such as supply volts, temperature, clock rates, and frequency and amplitude of the analogue signal to be varied, and show the resulting effects on the final digit stream. Details are also included for circuit improvements, resulting from the simulation, to give increased dynamic range to the coding process. Comparison between the simulated parameters and those measured on a sample coder gave a close correlation. This led to a fuller understanding of the operation of what is essentially a complex oscillating feedback circuit. GRA

N73-27137# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
K-SPACE FORMULATION OF THE TWO-DIMENSIONAL ELECTROMAGNETIC SCATTERING PROBLEM
Charles H. Krueger, Jr. Feb. 1973 116 p refs
(AF Proj. 7633)
(AD-760773; AFAL-TR-72-267) Avail: NTIS CSCL 20/14

The Air Force has become increasingly interested in the numerical solution of electromagnetic scattering and radiation problems as a means of reducing the cost and time associated with the experimental solution of such problems. In the frequency range where body dimensions are comparable to the wavelength of the illuminating electromagnetic energy, it has been found that moment methods provide satisfactory numerical solutions to these problems. However, as the body dimensions become larger than, say two or three wavelengths, the computation time and computer memory size associated with moment methods

become prohibitive. The method of solution described in the report is designed to significantly reduce both computation time and memory size required for moment method calculations.
Author (GRA)

N73-27138# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
FAST SPECTRAL ANALYSIS OF LINEARLY SWEPT SIGNALS Physical Sciences Research Papers
D. G. Shankland 27 Feb. 1973 36 p refs
(AF Proj. 4643)
(AD-760775; AFCRL-TR-73-0121; AFCRL-PSRP-536) Avail: NTIS CSCL 09/4

An algorithm is developed for computing the cross correlation between a given digitally recorded signal and a set of standard signals of the form S(omega, alpha, t) = exp (omega t + alpha t squared), corresponding to a signal whose frequency varies linearly with time. A code is presented for the CDC 6600 computer, and discussed sufficiently to enable programs to be written for other machines. Text data is included for debugging purposes.
GRA

N73-27139# California Univ., Los Angeles. School of Engineering and Applied Science.
DISCRETE TRANSFORM METHODS IN ADAPTIVE RADAR DETECTION
Joseph Salzman Apr. 1973 193 p refs
(Contract N00014-69-A-0200-4038)
(AD-761219; UCLA-ENG-7331) Avail: NTIS CSCL 17/9

The use of Discrete Transforms in adaptive radar detection systems operating in colored noise environment is studied. The trade-off between the gain in computational economy and the loss of functional performance affected by suboptional transforms is evaluated. It is concluded that in situations where signal option is available there exist no advantages for transform processing; asymptotic convergence to optimal performance and substantial savings in computation can be achieved in real-time processing. If signal design is restricted, suboptimal transform processing is essential to manage the computational requirement imposed by the adaptive nature of the detector. In such cases the Fourier and Walsh transforms were compared as likely candidates. The author found the FFT superior as it bounds the performance degradation in the worst case analysis.
Author (GRA)

N73-27140# Syracuse Univ., N.Y. Dept. of Electrical Engineering.
DESIGN FEASIBILITY STUDY OF THE VHF TRANSMITTER TIME SHARING SYSTEM Final Report
Jose Perini, Karl F. Williams, and Dale R. Parfitt Dec. 1972 102 p refs
(Contract DOT-FA71WAI-233)
(AD-758567) Avail: NTIS CSCL 17/2

The study was undertaken to investigate the theoretical and experimental feasibility of time-sharing the voice-modulated output of several collocated transmitters and receivers based on encouraging results with VHF transmitters. The theory of time-sharing operation is generally applicable to any transmitters but the design effort and trade-off study of performance variables were largely based on a specific transmitter model with its unique AM characteristics. The experimental results of this work are in good agreement with the theoretical computations and lend encouragement to the further exploitation of this time-sharing scheme for operational use with prescribed allowances for some spectral-spreading effects. S set of system parameters has been optimized for the operation of four transmitter/receiver pairs in time-sharing mode.
Author (GRA)

N73-27141# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sciences.
MICROWAVE LINK PERFORMANCE MEASUREMENTS AT 8 AND 14 GHz Final Report
R. E. Skerjanec and C. A. Samson Oct. 1972 55 p refs
(Contract DOT-FA65WAI-86)
(AD-756605; FAA-RD-72-115) Avail: NTIS CSCL 17/2

Received signal level recordings were made at 8 and 14 GHz for one year on a 31-mile microwave relay link in southeastern Colorado. Data were processed with a switch-combiner simulator to determine the effect of dual diversity with selection combining. This study indicated improved performance for frequency, space, and crossband diversity configurations. Meteorological effects on link performance were also investigated.
Author (GRA)

N73-27142# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A HIGH PERFORMANCE, LOW COST AIR TRAFFIC CONTROL RADAR
Charles E. Mueche, Jr. and Lincoln Cartledge 15 Feb. 1973 45 p refs
(Contract F19628-73-C-0002; AF Proj. 649L)
(AD-759179; TN-1973-12; ESD-TR-73-62) Avail: NTIS CSCL 17/9

Recent improvements in the technology of electronically switched antennas and digital signal processing make possible a relatively high performance, low cost, surveillance radar. The radar described employs an electronically step-scanned, cylindrical antenna together with an advanced digital signal processor to give superior MTI performance at an estimated cost of less than half the present S-band ASRs. The radar output consists of narrow band, digital target reports free of false alarms, suitable for transmission over telephone lines. Remote radar operation using digital, bright, scan-history displays becomes practical as does easy incorporation of beacon and direction finder outputs along with digitally generated video maps. The complete absence of moving parts, the low power transmitter and the largely solid-state construction will provide high reliability and low maintenance costs. (Author Modified Abstract)
GRA

N73-27833* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ERTS WIDEBAND TAPE RECORDER
John M. Hayes *In its* Significant Accomplishments in Technol., 1972 1973 p 67-70 (For availability see N73-27816 18-34)
CSCL 14C

N73-27841* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ADAPTIVE GROUND IMPLEMENTED PHASE ARRAY
Robert E. Spearing *In its* Significant Accomplishments in Technol., 1972 1973 p 103-108 (For availability see N73-27816 18-34)
CSCL 17B

N73-27843* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HIGH EFFICIENCY GROUND DATA TRANSMISSION
William B. Dickinson *In its* Significant Accomplishments in Technol., 1972 1973 p 113-115 (For availability see N73-27816 18-34)
CSCL 17B

N73-27856* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ATS-5 MILLIMETER WAVE PROPAGATION MEASUREMENTS
Louis J. Ippolito *In its* Significant Accomplishments in Technol., 1972 1973 p 171-174 (For availability see N73-27816 18-34)
CSCL 20N

N73-27857* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COORDINATION PROCEDURE FOR RADIO RELAY AND COMMUNICATION SATELLITE SERVICES
Jerome Eckerman *In its* Significant Accomplishments in Technol., 1972 1973 p 175-178 (For availability see N73-27816 18-34)
CSCL 17B

N73-27862* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VOICE INTELLIGIBILITY IN SATELLITE MOBILE COMMUNICATIONS
Sheldon Wishna *In its* Significant Accomplishments in Technol., 1972 1973 p 195-198 (For availability see N73-27816 18-34)
CSCL 17B

N73-27863* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A ZERO-ERROR OPERATIONAL VIDEO DATA COMPRESSION SYSTEM
Richard L. Kutz *In its* Significant Accomplishments in Technol., 1972 1973 p 199-204 (For availability see N73-27816 18-34)
CSCL 05B

N73-27864* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HEALTH/EDUCATION TELECOMMUNICATIONS EXPERIMENT
Albert A. Whalen *In its* Significant Accomplishments in Technol., 1972 1973 p 204-207 (For availability see N73-27816 18-34)
CSCL 17B

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N73-27143*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BEAMR: AN INTERACTIVE GRAPHIC COMPUTER PROGRAM FOR DESIGN OF CHARGED PARTICLE BEAM TRANSPORT SYSTEMS
Regis F. Leonard and Charles C. Giamati Washington Jul. 1973 45 p refs
(NASA-TN-D-7352; E-7384) Avail: NTIS HC $3.00 CSCL 09B

A computer program for a PDP-15 is presented which calculates, to first order, the characteristics of charged-particle beam as it is transported through a sequence of focusing and bending magnets. The maximum dimensions of the beam envelope normal to the transport system axis are continuously plotted on an oscilloscope as a function of distance along the axis. Provision is made to iterate the calculation by changing the types of magnets, their positions, and their field strengths. The program is especially useful for transport system design studies because of the ease and rapidity of altering parameters from panel switches. A typical calculation for a system with eight elements is completed in less than 10 seconds. An IBM 7094 version containing more-detailed printed output but no oscilloscope display is also presented. Author

N73-27144# National Physical Lab., Teddington (England). Div. of Computer Science.
AUTOMATIC ERROR CORRECTION IN NATURAL TEXTS, SUPPLEMENT
A. J. Szanser Jan. 1973 19 p Supplement to NPL-Com-Sci-46: See N71-35330
(NPL-Com-Sci-63-Suppl) Avail: NTIS HC $3.00

A method for automatic error correction in natural texts, elastic matching, processed by a computer is investigated. It includes automatic error correction of short words and abbreviations and the treatment of disjoint and fused words, as well as the case in which a letter is transferred from one word to another. It was concluded that the methods of automatic error correction can be extended to words of any length and also to certain combinations of two successive words in a natural text. ESRO

N73-27145# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
REUTILIZATION OF THE MINUTEMAN GUIDANCE COMPUTER AS A NUMERICAL/PROCESS CONTROLLER M.S. Thesis
Raymond V. Cicirelli and John H. Hill Mar. 1973 149 p refs
(AD-760757; GE/EE/73-5) Avail: NTIS CSCL 09/2

As a result of the D17B computers from the Minuteman I missiles being made available to qualifying organizations, several studies have been implemented to assess the usefulness and adaptability of the D17B in other applications. The report is directed toward their use in control applications. The report outlines a few of the basic concepts of numerical control and process control toward the end of adopting these computers to those purposes. The primary emphasis is on numerical control with merely a small account being given of process control. The primary functional features of the computer are presented in detail for the D17B and merely mentioned in passing for the D37C computer (Minuteman II) with the expressed hope that the results of the work can be applied to the D37C. (Author Modified Abstract) GRA

N73-27146# Clarkson Coll. of Technology, Potsdam, N.Y.
FAULT DETECTION METHODS IN COMBINATIONAL DIGITAL LOGIC NETWORKS
Harold M. Levy and David W. Bray Jan. 1973 134 p refs (Contract F30602-72-C-0463)
(AD-760543; RADC-TR-72-345) Avail: NTIS CSCL 09/2

The ability to test a digital network as simply as possible has become quite important recently due to advances in integrated circuit technology and the consequent increases in the complexity of the networks being produced. The paper presents several existing methods of fault detection test generation. A new approach to the problem of finding a minimal test set is then presented. The test set is obtained by solving a set of equations which are obtained directly from the network. It is shown that the solutions to these equations constitute a complete test set both for a nonreconvergent fanout network and for a reconvergent fanout network. A general solution procedure is presented which will generate a minimal test set for any network. An algorithm for generating a minimal test set for a nonreconvergent fanout network is also presented. Author (GRA)

N73-27147# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DESIGN EXPANSION OF THE D17B COMPUTER INPUT/OUTPUT FACILITY FOR GENERAL PURPOSE APPLICATIONS M.S. Thesis
Joseph R. T. Theriault 21 Mar. 1973 299 p refs
(AD-760761; GE/EE/73-20) Avail: NTIS CSCL 09/2

In an effort to determine the extent to which the capabilities of the D17B computer can be applied to general-purpose information processing tasks, the report presents the results of a study of the input/output structure of the machine. A technique is presented which enables the processor to transfer data to and from peripheral equipment on a program-controlled basis and at a rate which approaches the execution rate of the processor. The technique employs a bus-structured I/O system which also controls program loading and verification operations to achieve the 800 char/sec maximum loading rate of the computer. Another technique is presented which applies certain specialized functions of the D17B to directly link high-speed peripheral equipment with the memory for output transfers. By using this partial direct-memory access method, a transfer rate of 12.8K words/sec can be achieved. (Author Modified Abstract) GRA

N73-27148# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A RELOCATABLE ASSEMBLER AND ASSOCIATED LOADER FOR THE D17B MINUTEMAN GUIDANCE COMPUTER M.S. Thesis
Donald D. Henson Mar. 1973 181 p refs
(AD-760758; GE/EE/73-12) Avail: NTIS CSCL 09/2

The D17B Minuteman Guidance Computer is a serial data processor with a rotating disk memory. After conversion to laboratory use at AFIT, the problem of programming in machine language remained. The addition of an I/O system has allowed the development of a relatively sophisticated operating system and assembler. The D17B Operating System uses a punched paper tape library to load and execute programs under the direction of commands entered at a teletype keyboard. The Minuteman Assembler is designed to work with the relocatable program loader. The assembly language is designed using customary syntax and semantics where possible. External references are allowed. The assembler is to be implemented in a segmented format to allow more sophisticated features in the small memory of the D17B computer. (Author Modified Abstract) GRA

N73-27823* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE DATA PROCESSOR FROM THE SMALL SCIENTIFIC SATELLITE
Harry G. McCain *In its* Significant Accomplishments in Technol., 1972 1973 p 25-27 (For availability see N73-27816 18-34)
CSCL 09B

N73-27824* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE ONBOARD PROCESSOR ON OAO-3
Thomas D. Taylor *In its* Significant Accomplishments in Technol., 1972 1973 p 28-31 (For availability see N73-27816 18-34)
CSCL 09B

N73-27827* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TWO DIMENSIONAL DIGITAL COMPUTER
David H. Schaefer *In its* Significant Accomplishments in Technol., 1972 1973 p 42-44 (For availability see N73-27816 18-34)
CSCL 09B

N73-27849* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MISALIGNMENT ESTIMATION SOFTWARE SYSTEM
Richard L. DesJardins *In its* Significant Accomplishments in Technol., 1972 1973 p 136-139 (For availability see N73-27816 18-34)
CSCL 09B

N73-27851* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPUTER ASSISTED INTERACTIVE RESOURCE SCHEDULING SYSTEM
Carl E. Gustafson *In its* Significant Accomplishments in Technol., 1972 1973 p 143-146 (For availability see N73-27816 18-34)
CSCL 09B

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N73-27149 National Lending Library for Science and Technology, Boston Spa (England).
DETERMINATION OF THE DYNAMIC ZONE OF SPARKLESS COMMUTATION OF dc MACHINES BY MEANS OF FREQUENCY CHARACTERISTICS
W. Paszek and T. Glinka Apr. 1973 33 p refs Transl. into ENGLISH from Arch. Elektrotech. (Warsaw), v. 19, no. 1, 1970 p 135-161
(NLL-RTS-7771) Avail: Natl. Lending Library, Boston Spa, Engl.: £3.20; 11 NLL photocopy coupons

An analysis was made of commutating pole flux at linearly and sinusoidally changing load current. The frequency characteristics and transfer functions of the quadrature magnetic circuit of the machine are derived, and a method is given for their determination from measurements carried out with dc and ac at one frequency, e.g. 50 Hz. This arrangement is of practical importance for the testing of machines in their installation sites. A method is given for finding the dynamic zone of sparkless commutation for linear and sinusoidal changes of load current. This method is helpful in estimating commutation in transient load current. The measurement results are included. Author

N73-27150*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
WIDE TEMPERATURE RANGE ELECTRONIC DEVICE WITH LEAD ATTACHMENT Patent
Richard Farrell, inventor (to NASA) Issued 26 Jun. 1973 5 p Filed 28 Jan. 1972 Supersedes N72-21253 (10 - 12, p 1587) Continuation-in-part of US Patent Appl. SN-868775, filed 23 Oct. 1969
(NASA-Case-ERC-10224-2; US-Patent-3,742,316; US-Patent-Appl-SN-221833; US-Patent-Class-317-234R; US-Patent-Class-317-234G; US-Patent-Class-317-234L; US-Patent-Class-317-234M; US-Patent-Class-317-234N; US-Patent-Class-29-580; US-Patent-Appl-SN-868775) Avail: US Patent Office CSCL 09A

A electronic device including lead attachment structure which permits operation of the devices over a wide temperature range is reported. The device comprises a core conductor having a thin coating of metal thereon whereby only a limited amount of coating material is available to form an alloy which bonds the core conductor to the device electrode, the electrode composition thus being affected only in the region adjacent to the lead.
Official Gazette of the U.S. Patent Office

N73-27151 Auburn Univ., Ala.
HIGH-POWER CHARACTERISTICS OF IMPATT AMPLIFIERS Ph.D. Thesis
John Wyatt Amoss 1972 107 p
Avail: Univ. Microfilms Order No. 73-1897

Analytical methods are evaluated by which the large-signal characteristics of impatt microwave amplifiers can be determined. The equations which govern the large-signal impedance of the Read-type diode are presented and solved by a weighted-residual method. The solution is valid for arbitrary transit angles and converges rapidly for a wide range of operating conditions. Results from this method of solution are compared with Gilden and Hines' small-signal, arbitrary transit angle solution and with Evans' large-signal, short transit angle solution. It is shown that for small RF voltages, the results obtained from this solution agree with Gilden and Hines' solution for arbitrary transit angles. For large RF voltages, the solution agrees with that of Evans when the transit angle is made to approach zero. The set of equations which results from this method can not be solved directly. They can, however, be solved by an iteration method which converges rapidly. A FORTRAN 4 computer program was written for solving these equations and is included. Dissert. Abstr.

N73-27152 Stanford Univ., Calif.
OPTIMIZED EARTH TERMINAL ANTENNA SYSTEMS FOR BROADCAST SATELLITE Ph.D. Thesis
Ching Chun Han 1972 196 p
Avail: Univ. Microfilms Order No. 73-4507

An analysis was made of the antenna characteristics of a low cost mass producible ground station to be used in broadcast satellite systems. It is found that a prime focus antenna is sufficient for a low cost but not a low noise system. Zoned reflectors are analyzed and appear to be attractive from the standpoint of cost. However, these reflectors suffer a gain reduction of about one db and a possible increase in sidelobe levels. The off-axis gain of a non-auto-tracking station can be optimized by establishing a special illumination function at the reflector aperture. A step-feed tracking system is proposed to provide automatic procedures for searching for peak signal from a geostationary satellite. Protection ratios of FM television and telephone systems were analyzed and standard small antenna sidelobe pattern models were established to provide a guideline for properly choosing the satellite spacings. Dissert. Abstr.

N73-27153*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
DIGITAL SERVO CONTROLLER Patent Application
Frank Byrne, inventor (to NASA) Filed 28 Jun. 1973 18 p (NASA-Case-KSC-10769-1; US-Patent-Appl-SN-374583) Avail: NTIS HC $3.00 CSCL 09A

A system is reported for generating a signal for controlling the rotation of a shaft supporting an antenna so that the antenna is rotated the shortest angular distance from a present angular position to a new desired angular position. The system comprises a shaft encoder which generates a digital encoder signal indicating the present position of the shaft. A command signal is compared with the encoder signal to produce an analog signal for rotating the antenna. An error signal is produced for controlling the direction of rotation of the antenna. NASA

N73-27154*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
VAMISTOR RESISTOR INVESTIGATION
1 May 1973 221 p

(NASA-TM-X-64754) Avail: NTIS HC $3.25 CSCL 09A

Results are presented of the failure investigation conducted on resistors produced by the Vamistor Divison, Wagner Electric Corporation. This failure investigation included; failure analyses, chemical and metallurgical analyses, failure mechanism studies, seal leak analyses, and nondestructive stress tests. The data, information, conclusions, and recommendation can be helpful in assessing current usage of these resistors. Author

N73-27155# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).

NONLINEAR AND PARAMETRIC EFFECTS IN ELECTRON TRANSFER GENERATORS Annual Report [ETUDE DES EFFETS NON LINEAIRES ET PARAMETRIQUES DANS LES OSCILLATEURS A TRANSFERT D'ELECTRONS RAPPORT ANNUEL]

F. Diamand Dec. 1971 8 p refs In FRENCH

(Contract DGRST-70-72-355)

Avail: NTIS HC $3.00

Experimental methods, based on relations established by theory between the form of the synchronization ellipse and certain electric characteristics of a microwave oscillator based on electron transfer are defined. Theories of synchronization and of mixing of a negative resistance oscillator were developed, based on hypotheses with certain restrictions. The dynamic resistance of the diode for large signals can be determined from the synchronization ellipse. ESRO

N73-27156# Societe Europeenne de Semiconducteurs et de Microelectronique, Paris (France). Lab. de Recherches.

PHYSICAL PHENOMENA OCCURRING IN CHARGE TRANSFER DEVICES Final Report [ETUDE DES PHENOMENES PHYSIQUES INTERVENANT DANS LES DISPOSITIFS A TRANSFERT DE CHARGE COMPTE RENDU FINAL]

R. Poirier, N. Szydlo, J. Olivier, and L. E. N. Lakoua 14 Dec. 1971 153 p refs In FRENCH

(Contract DRME-70/34.388.09.480.75.01)

Avail: NTIS HC $9.75

Three aspects of conduction phenomena at metal-dielectric, semiconductor-dielectric, and dielectric-vacuum interfaces were studied in order to improve the functioning of image transducer and metal semiconductor devices. The metal-semiconductor and metal-dielectric contacts were investigated using aluminum-n silicon and Al-Al2O3-Si. The potential barriers were measured either by photoemission, or from the 1(V) and C(V) characteristics in the case of an Al-Si contact. The interaction of silicon with a slow electron beam showed that an injected electron thermalized and could traverse several thousands of Angstrom before being trapped. The charge transfer phenomena at a silicon surface were investigated by transfer from a MOS capacitance to a neighboring capacitance in the same substrate. ESRO

N73-27157# TRW, Inc., Lawndale, Calif. Semiconductor Div.

SOLID STATE AMPLIFIER LINEARIZATION TECHNIQUES FOR INTERFERENCE REDUCTION IN USAF COMMUNICATIONS SYSTEMS Final Technical Report

Edward R. Moss and Roger DeBloois Griffiss AFB, N. Y. RADC Jan. 1973 97 p refs

(Contract F30602-71-C-0247)

(AD-757558; TRW-71-0247; RADC-TR-73-10) Avail: NTIS CSCL 09/5

The development of the TRW J02009 linear power transistor and the design of a broadband UHF amplifier using these transistors are described. The amplifier uses two J02009 transistors with hybrid power splitting and summing techniques to combine the two transistors. The amplifier has a bandwidth of 225 to 400 MHz, a peak envelope output power of 50 watts, and gain that vanes from 8 db to 14 db over the band. (Author Modified Abstract) GRA

N73-27158# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

PASSIVE DETECTION AND RANGING OF A GROUND RADAR FROM AN AIRCRAFT USING AN EXTENDED KALMAN FILTER M.S. Thesis

David Henry Watjen Mar. 1973 116 p refs

(AD-760764; GGC/EE/73-20) Avail: NTIS CSCL 15/3

The dynamic equations between a moving aircraft and a stationary ground based radar transmitter are used to design an extended Kalman filter for determining the location of the transmitter with respect to the aircraft. Emphasis is placed on obtaining the range of the transmitter from the aircraft. The only inputs available to the filter are the velocity and attitude of the aircraft and the bearing and elevation angles which the transmitters radar beam makes with the aircraft. The filter is implemented on a digital computer and its performance is observed for various flight paths of the aircraft. The time for the error in the estimate in range to decrease to specified values is tabulated for comparison. Author (GRA)

N73-27159# General Electric Co., Syracuse, N.Y. Heavy Military Electronic Systems.

HYBRID MODE TRACKING FEED TECHNIQUES STUDY Final Report, 13 Mar. - 13 Dec. 1972

Thomas E. Manwarren and Andrew Farrar Griffiss AFB, N. Y. RADC Mar. 1973 70 p refs

(Contract F30602-72-C-0171)

(AD-759834; RADC-TR-73-71) Avail: NTIS CSCL 09/5

Equations were developed for the hybrid mode fields which exist in a square corrugated waveguide. Propagation constants were obtained for the various modes of interest. A hybrid-mode tracking feed horn was designed and tested, and its characteristics compared with those obtained analytically. Evaluation was based on radiation characteristics, VSWR, bandwidth, and channel isolation. Emphasis was placed in two areas: first, to show the radiation characteristics the feed horn would have if working perfectly and second, to obtain a good understanding of the feed system to point out the areas requiring further effort. GRA

N73-27160# United Aircraft Corp., East Hartford, Conn. Research Labs.

SPUTTERED THIN FILM RESEARCH Semiannual Technical Report, 16 Oct. 1972 - 15 Apr. 1973

Alexander J. Shuskus, Daniel J. Quinn, Edward L. Paradis, James M. Berak, and Thomas M. Reeder 27 May 1973 61 p refs

(Contract N00014-72-C-0415; ARPA Order 2173)

(AD-760715; UARL-M951337-6; SATR-2) Avail: NTIS CSCL 09/1

Current progress toward establishing the feasibility of reactive rf sputtering as a means of preparing single crystal films suitable for integrated optics and electronics applications is discussed. Single crystal films of aluminum nitride, zinc oxide, rutile and gallium arsenide have been successfully grown by this technique. Epitaxy of aluminum nitride and zinc oxide has been obtained on (0001) and (1,-1,0,2) sapphire substrates, rutile on (1,-1,0,2) sapphire and gallium arsenide on semi-insulating substrates of gallium arsenide. Surface acoustic wave delay lines were fabricated to evaluate the piezoelectric qualities of the zinc oxide and aluminum nitride films. The piezoelectric coupling coefficients determined indicate that the quality of the sputtered films is comparable to the best results reported for films prepared by chemical vapor deposition. GRA

N73-27161# Army Electronics Command, Fort Monmouth, N.J.

VSWR MEASUREMENTS OF ANTENNA SYSTEM INSTALLATIONS ON ARMY AIRCRAFT

James T. Maguire, Edmund T. Tognola, and Joseph H. Huggins May 1973 35 p refs

(DA Proj. 1F2-64201-DC-97)

(AD-761031; ECOM-4114) Avail: NTIS CSCL 09/5

The report describes a new antenna sweeping method which gives a rapid, accurate measurement of VSWR over a designated frequency spectrum. This new method offers technical and procedural advantages over alternate methods and it is compared with regard to cost and time consumption with two other methods presently being used. Theory of operation, test setup, and test procedures are given for each of the three methods Test results using the new method on various antenna systems are tabulated and its potential applications are summarized. Author (GRA)

N73-27162# Radio Corp. of America, Princeton, N.J.

OPTOELECTRONIC ELECTRON EMITTER Final Report, 15 Oct. 1970 - 31 Dec. 1972

Horst E. P. Schade, Herbert Nelson, Henry Kressel, and Wieslaw

W. Siekanowicz May 1973 64 p refs
(Contract DAAB07-71-C-0059; ARPA Order 1686)
(AD-760601; PRRL-73-CR-11; ECOM-0059-F) Avail: NTIS CSCL 09/1

The report describes research performed during a two-year period in order to develop a semiconductor cold-cathode electron emitter with emission properties suitable for practical applications. Greatly improved cold-cathode structures based on negative electron affinity surfaces and on GaAs-(AlGa)As heterojunction structures grown by liquid phase epitaxy were developed. The key to the successful development of this device was the ability to obtain highly doped p-type GaAs with electron-diffusion lengths as high as about 5 to 7 micrometers and a technique for the confinement of the carrier flow to the desired emitting area. Extensive studies on dc operation and cathode life were conducted under continuously pumped vacuum conditions as well as in sealed tubes, and operation was obtained for a period of 360 hr. (Modified author (Author Modified Abstract) GRA

N73-27163# Clarkson Coll. of Technology, Potsdam, N.Y. Dept. of Electrical and Computer Engineering.
AN EXPERIMENTAL STUDY OF NOISE IN MNOSFET DEVICES
Robert F. Cotellessa and Peter C. Hart Jan. 1973 135 p refs
(Contract F30602-72-C-0463; AF Proj. 9567)
(AD-760544; RADC-TR-72-346) Avail: NTIS CSCL 09/1

The theory of the operation of metal-nitride-oxide-semiconductor field effect transistors (MNOSFET's) is briefly presented, as is the theory of noise in metal-insulator-semiconductor field effect transistors (MISFET's). The noise theory, as developed for a MISFET device, shows the noise to be dependent upon both the gate-to-source voltage and the threshold voltage. Since a MNOSFET device is a variable thresholding device, it is probable that the noise of such a device would be dependent upon the state of the device. Indeed, this has been shown to be the case. An experimental investigation of the noise of the MNSOFET device is accomplished using a digital spectral analysis measurement system. The measurement system is based upon a digital correlation analysis followed by a computation of a fast Fourier transformation in order to obtain the noise power spectrum. Author (GRA)

N73-27164# Northrop Corp., Hawthorne, Calif.
EBS DIODE ARRAYS Final Report, 10 Jul. 1972 - 10 Feb. 1973
Klaus K. Schuegraf May 1973 56 p refs
(Contract DAAB07-72-C-0286; DA Proj. 156-62705-A-055)
(AD-760602; NRTC-73-8R; ECOM-0286-F) Avail: NTIS CSCL 09/1

The objective of the study was to determine methods of fabricating an array of silicon diodes for application in an electron beam semiconductor device. Diode array lateral dimensions were defined in the procurement specification. Poly silicon and phosphorous glass passivation layers were evaluated for their effects on the diode reverse characteristics under electron bombardment. Several of the 10 diode arrays were fabricated, tested and evaluated. Recommendations for making contacts to the top and bottom metal layers were also made. Ten diode arrays meeting the specified parameters were delivered to USAECOM for evaluation and use. Author (GRA)

N73-27165# Lincoln Lab., Mass. Inst. of Tech., Lexington.
FREQUENCY-SELECTIVE LIMITER AND ITS APPLICATION IN A FILTER BANK RECEIVER
Rex C. S. Chien 13 Apr. 1973 63 p refs
(Contract F19628-73-C-0002; AF Proj. 627A)
(AD-760817; TN-1973-1; ESD-TR-73-81) Avail: NTIS CSCL 09/5

The operating theory of parametric FSL's (frequency-selective limiters) and the measured results of a yttrium iron garnet (YIG) FSL under different signal environments are reported. Emphasis is given to application YIG FSL's as level normalizers in a filter bank receiver. YIG FSL operation is discussed via a basic analytical model. In this study, transient response to pulsed RF signals, frequency modulated signals, small signal suppression and intermodulation product phenomena when two signals are simultaneously received, are also reported. Experimental results obtained agree with the analytical model. Extensive data are provided to facilitate design of YIG FSL's in filter bank receivers. Specific applications for YIG FSL's are present: YIG FSL as a level normalizer, cascading YIG FSL's to obtain large limiting range, threshold level detection influenced by small signal suppression, and use of a YIG FSL to offset amplitude reduction of bandpass filters caused by a sweep signal. A filter bank receiver comprising YIG FSL's is presently under construction. (Author Modified Abstract) GRA

N73-27166# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DIRECTIONAL COUPLER DESIGN USING COPLANAR WAVEGUIDE M.S. Thesis
Earl W. Williams Mar. 1973 60 p refs
(AD-760533; GE/EE/73-24) Avail: NTIS CSCL 09/1

Coplanar Waveguide (CPW) is a surface transmission line having properties that make it attractive for microwave integrated circuit applications. The CPW was investigated primarily to develop a design procedure for a directional coupler; however, it was necessary to first determine the effects of a finite substrate thickness on the effective dielectric constant. A Schwarz-Christoffel transformation was used to map the CPW boundaries into a rectangular region to simplify the analysis. (Author Modified Abstract) GRA

N73-27167# Sperry Rand Research Center, Sudbury, Mass.
TRAPATT AMPLIFIER FOR PHASED ARRAYS Interim Technical Report, 24 Jan. - 24 Sep. 1972
Martin I. Grace, Harry Kroger, and Harold J. Pratt Mar. 1973 42 p refs
(Contract F30602-72-C-0202)
(AD-760545; SRRC-CR-72-17; RADC-TR-73-26) Avail: NTIS CSCL 09/5

The report describes the present status in the design of a broadband CW TRAPATT amplifier in microwave circuit form, whose coaxial analog was originally under Contract F30602-70-C-0110. Progress toward the development of CW devices is described with emphasis on surface degradation effects and approaches toward solving this difficulty. An amplifier broad-banding technique and the use of small-area devices to achieve lower input power thresholds for CW operation are also described. Author (GRA)

N73-27168# Westinghouse Electric Corp., Baltimore, Md. Systems Development Div.
BINARY ADDRESSABLE SCAN CONVERSION STORAGE TUBE Quarterly Report, 15 Oct. 1972 - 14 Jan. 1973
D. Mergerian, J. W. Ogland, H. J. Bourg, I. Limansky, and J. C. Bradley May 1973 21 p
(Contract DAAB07-72-C-0052)
(AD-761099; ECOM-0052-5-72; QR-5) Avail: NTIS CSCL 09/1

The objective of the contract is to conduct a research and development program leading to the fabrication, testing, and delivery of a binary-addressable scan-converter storage tube. The tube is to be capable of simultaneous write and non-destructive read operation at video frequency up to 10 megahertz. Three selector-plates with hole-arrays have been drilled this quarter. Thirty-six hours of continuous drilling are required per plate. The major portion of the effort this quarter has been directed toward correcting problems with the laser drill facility so that the tolerances of hole locations can be met. A major portion of the optics of the laser drill was re-designed and re-worked to correct beam-wandering during drilling. Also several problems with cleaning of the wafers both before and after drilling have been corrected. Author (GRA)

N73-27169# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
THEORETICAL AND EXPERIMENTAL INVESTIGATIONS ON COUPLED ANTENNAS IN HOMOGENEOUS ISOTROPIC MEDIA
Larry D. Scott and S. R. Mishra Apr. 1973 82 p refs
(Contract N00014-67-A-0298-0005; NR Proj. 371-016)
(AD-761167; TR-641) Avail: NTIS CSCL 09/5

Two representations previously introduced for the distribution of current in an isolated antenna in a general, infinite, homogeneous, is otropic medium have been used to solve the simulataneous

integral equations for the currents in coupled dipole antennas. These are a polynomial and a trigonometric form, each with an exponential multiplier. A description of the apparatus for measuring the properties of coupled antennas is also presented together with tables of measured admittance, current and charge distributions. A comparison of the theoretical and experimental results shows fairly good agreement. Author (GRA)

N73-27170# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
PRECISION SINGLE SIDEBAND CRYSTAL UNITS Final Report, 15 Dec. 1971 - 31 Jan. 1973
Raymond K. Hart and W. H. Hicklin May 1973 81 p refs
(Contracts DAAB07-72-C-0087; DAAB07-72-Q-0060)
(AD-761101; GIT-A-1388-F; ECOM-0087-F-72) Avail: NTIS CSCL 09/1

The purpose of the work is to develop single sideband (SSB) quartz crystal units which exhibit long-term aging of < plus or minus 2x10 to the minus 10th power /week when measured at the upper turning point (UTP) of 62C, and after a stabilization period of four weeks. In addition to the low aging requirement, the frequency hysteresis that often occurs under conditions of varying temperatures was investigated. Two concurrent work programs were employed to (a) fabricate resonators under precisely controlled conditions and (b) investigate their characteristics. The results of this work indicate that the performance of quartz resonators can be improved by fabricating them in systems and from materials that enable precise control of variables to be exercised. Monitoring of these variables by suitably sensitive instrumentaion is essential. (Author Modified Abstract) GRA

N73-27830* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN IRONLESS ARMATURE BRUSHLESS TORQUE MOTOR
Phillip A. Studer *In its* Significant Accomplishments in Technol., 1972 1973 p 53-55 (For availability see N73-27816 18-34) CSCL 09A

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N73-27171* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FILTER FOR THIRD ORDER PHASE LOCKED LOOPS Patent
Robert B. Crow and Robert C. Tausworthe, inventors (to NASA) Issued 19 Jun. 1973 13 p Filed 6 Apr. 1972 Supersedes N72-27249 (10 - 18, p 2404) Sponsored by NASA
(NASA-Case-NPO-11941-1; US-Patent-3,740,671; US-Patent-Appl-SN-241614; US-Patent-Class-330-70CR; US-Patent-Class-331-17; US-Patent-Class-331-25) Avail: US Patent Office CSCL 09C

Filters for third-order phase-locked loops are used in receivers to acquire and track carrier signals, particularly signals subject to high doppler-rate changes in frequency. A loop filter with an open-loop transfer function and set of loop constants, setting the damping factor equal to unity are provided.
Official Gazette of the U.S. Patent Office

N73-27172 Stanford Univ., Calif.
LOW VOLTAGE COMPLEMENTARY BIPOLAR DIGITAL INTEGRATED CIRCUITS Ph.D. Thesis
Stephen Chung-Wen Su 1972 241 p
Avail: Univ. Microfilms Order No. 73-4608

The power consumption and switching times of micropower complementary bipolar transistor inverters have been insensively investigated. A comparison of the power-speed performance of a complementary inverter and a single-ended inverter has been carried out both theoretically and experimentally. The pnp transistor which replaces the collector resistor in the single-ended inverter eliminates the large saturated transistor collector current and improves greatly the switching speed and fan-out capability of the inverter. For the same dc standby power, the maximum frequency of operation of a complementary inverter is generally an order of magnitude higher than the single-ended inverter in the micropower range. A simple new monolithic (CBT) structure which is most attractive for low voltage, low power operation has been developed. Dissert Abstr.

N73-27173*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DESIGN AND EVALUATION OF AN OPTICAL FINE-POINTING CONTROL SYSTEM FOR TELESCOPES UTILIZING A DIGITAL STAR SENSOR
Aaron J. Ostroff and K. C. Romanczyk Washington Jul. 1973 66 p refs
(NASA-TN-D-7204; L-8677) Avail: NTIS HC $3.00 CSCL 14B

One of the most significant problems associated with the development of large orbiting astronomical telescopes is that of maintaining the very precise pointing accuracy required. A proposed solution to this problem utilizes dual-level pointing control. The primary control system maintains the telescope structure attitude stabilized within the field of view to the desired accuracy. In order to demonstrate the feasibility of optically stabilizing the star images to the desired accuracy a regulating system has been designed and evaluated. The control system utilizes a digital star sensor and an optical star image motion compensator, both of which have been developed for this application. These components have been analyzed mathematically, analytical models have been developed, and hardware has been built and tested. Author

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N73-27174# Atomic Weapons Research Establishment, Aldermaston (England).
TOPAL: A COMPUTER CODE FOR INVESTIGATING METAL-LIQUID THERMAL INTERACTIONS IN SHOCK-TUBE GEOMETRY. PART 1: THEORETICAL DESCRIPTION
K. Morgan Jun. 1973 11 p refs
(GRO/44/91/26-Pt-1; TRG-2459-Pt-1) Avail: NTIS HC $3.00

A description is given of the computer program TOPAL which was written to investigate metal-liquid thermal interactions under shock tube conditions. The program solves the Lagrangian equations of motion for one-dimensional unsteady compressible fluid flow in plane geometry. Author

N73-27175*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
WIND TUNNEL FLOW GENERATION SECTION Patent Application
Norman E. Sorensen, inventor (to NASA) Filed 13 Jul. 1973 16 p
(NASA-Case-ARC-10710-1; US-Patent-Appl-SN-379019) Avail: NTIS HC $3.00 CSCL 14B

An apparatus for generating acceptably uniform flow for the test section of a wind tunnel over a range of different flow velocities. More particularly, it has been found that by appropriately adjusting the length of the porous wall surfaces in the flow generation section of the wind tunnel to which a negative pressure is applied and by applying appropriate negative pressures, the flow through the test section of the wind tunnel can be made uniform. In its basic aspects, therefore, the apparatus comprises a pair of generally opposed, porous wall surfaces defining the flow generation section, means for selectively applying appropriate negative pressures to the exterior sides of such porous wall

surfaces, and means for selectively varying the length of such wall surfaces to which the negative pressure is applied. NASA

N73-27176*# Martin Marietta Corp., Denver, Colo.
ATTACHED MANIPULATOR SYSTEM DESIGN AND CONCEPT VERIFICATION FOR ZERO-g SIMULATION Final Report
R. Booker, W. Burkitt, P. Corveleyn, P. Cramer, O. Duwaik, C. Flatau, P. Garber, C. Grant, F. Greeb, C. Johnson et al Jun. 1973 498 p refs
(Contract NAS9-13027)
(NASA-CR-133964; JSC-08021) Avail: NTIS HC $27.00 CSCL 14B

The attached manipulator system (AMS) is to simulate and demonstrate zero-g shuttle manipulator cargo handling operations. It is not the design or development of the shuttle attached manipulator system (SAMS); however, every effort is being made, to insure that the AMS will be functionally similar to the SAMS. Author

N73-27177*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
DEVELOPMENT OF SIMULATION COMPUTER COMPLEX SPECIFICATION Final Report
29 Jun. 1973 195 p refs
(Contract NAS9-12882)
(NASA-CR-133965; MDC-E0857) Avail: NTIS HC $11.75 CSCL 14B

The Training Simulation Computer Complex Study was one of three studies contracted in support of preparations for procurement of a shuttle mission simulator for shuttle crew training. The subject study was concerned with definition of the software loads to be imposed on the computer complex to be associated with the shuttle mission simulator and the development of procurement specifications based on the resulting computer requirements. These procurement specifications cover the computer hardware and system software as well as the data conversion equipment required to interface the computer to the simulator hardware. The development of the necessary hardware and software specifications required the execution of a number of related tasks which included, (1) simulation software sizing, (2) computer requirements definition, (3) data conversion equipment requirements definition, (4) system software requirements definition, (5) a simulation management plan, (6) a background survey, and (7) preparation of the specifications. Author

N73-27178*# Scientific Translation Service, Santa Barbara, Calif.
ON THE ACCURACY OF AERODYNAMIC PARAMETERS FOR SIMULATION
B. Haftmann Washington NASA Jul. 1973 18 p refs Transl. into ENGLISH from DGLR report on the 3d Meeting of the DGLR-Symp., Flight Testing Technol., Oct. 1972 p 53-66
(Contract NASw-2483)
(NASA-TT-F-14994) Avail: NTIS HC $3.00 CSCL 14B

The procedure for developing the aerodynamic parameters for use in flight simulator research projects is described. Emphasis is placed on wind tunnel measurements to determine aerodynamic coefficients. Sources of error in wind tunnel measurements are analyzed. Procedures for compensating for errors arising during wind tunnel tests are explained. Results of a typical investigation are presented as graphs. Author

N73-27179# Parsons, Brinckerhoff, Quade and Douglas, New York.
ELEVATED STOL PORT TEST FACILITY CONCEPTUAL DEVELOPMENT AND COST STUDY Technical Report, 30 Jun. 1972 - 31 Jan. 1973
S. Rottenberg and A. H. Degraw Apr. 1973 56 p
(Contract DOT-FA72WA-3114)
(FAA-RD-73-15) Avail: NTIS HC $5.00

A cost analysis was conducted on construction of an elevated short takeoff and landing test facility. A suitable structural scheme was selected, cost estimates were prepared, and the location at the National Aviation Facilities Experimental Center was recommended. A similar analysis was conducted for a test facility located in a hypothetical metropolitan environment. The facility was conceptualized with the added consideration of future expansion to a passenger carrying facility. A comparision of the two test facilities was made based on structural, cost, and einvironmental considerations. Author

N73-27180# Douglas Aircraft Co., Inc., Long Beach, Calif.
PROCEDURES FOR DETERMINATION OF AIRPORT CAPACITY, VOLUME 1 Interim Report, Jun. 1972 - Jan. 1973
Apr. 1973 197 p refs Prepared in cooperation with McDonnell Douglas Automation Co., Am. Airlines, Inc., and Peat, Marwick, Mitchell and Co.
(Contract DOT-FA72WA-2897)
(FAA-RD-73-11-Vol-1) Avail: NTIS HC $12.00

Procedures for determining airfield capacity are discussed. Three major areas were investigated as follows: (1) definition of requirements for planning tools, (2) gathering of operational information relating to airport performance, and (3) development of models for analyzing airport capacity and causes for delays. A Monte Carlo simulation method and appropriate logic for the analysis are discussed. For volume 2 see ats 08622. Author

N73-27181# Joint Publications Research Service, Arlington, Va.
THE ZVENIGOROD EXPERIMENTAL STATION
V. P. Osipenko and V. A. Yurevich 20 Jul. 1973 10 p Transl. into ENGLISH from Zemlya i Vselennaya (Moscow), no. 6, 1972 p 54-57
(JPRS-59567) Avail: NTIS HC $3.00

A discussion is presented on the Zvenigorod Station, which was formed within the system of the Astronomical Council as an experimental station for optical observations of artificial earth satellites. The work of the station includes the designing and mastering of cameras for tracking satellites and the creation of new photographic methods of observation. Author

N73-27182*# Scientific Translation Service, Santa Barbara, Calif.
THE TRANSIENT BEHAVIOR OF CURRENTS AND FORCES IN THE COIL SYSTEM OF THE STELLARATOR W 7 ESPECIALLY DURING OPERATIONAL DISTURBANCES
H. Preis Washington NASA Aug. 1973 36 p refs Transl. into ENGLISH of "Das transiete verhalten von stroemen und kraeften im Spulensystem des Stellarators W 7 insbesondere Beibetriebsstoerungen", Max-Planck-Inst. fue Plasmaphys., Garching rept. no. IPP-4/109, Mar. 1973 36 p
(Contract NASw-2483)
(NASA-TT-F-15014; IPP-4/109) Avail: NTIS HC $3.75 CSCL 14B

The energy supply to the coil system (40 toroidally arranged single coils) by means of a high-power pulse generator is analyzed and the problems entailed are treated. What is actually involved is the determination of the transient coils currents during a pulse cycle. This calculation is done for trouble-free operation and for the case of sudden coil shorting. The currents calculated with allowance for all inductive coupling of the coil arrangement are used for determining the magnetic forces (Lorentz forces). The forces exerted on the coils in the event of operating trouble are determined as functions of both the time and short-circuit resistance. Author

N73-27183# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Apparate.
FURTHER DEVELOPMENT OF THE AUTOMATIC FLIGHT OPERATIONS SYSTEM AOOSY FOR THE INTEGRATED SATELLITE CONTROL SYSTEM ISK WEITERENTWICKLUNG DES AUTOMATISCHEN FLUGBETRIEBSSYSTEMS AOOSY ZUM INTEGRIERTEN SATELLITENKONTROLLSYSTEM ISK]
Peter Kuhn and Johannes Roosen 10 Apr. 1972 8 p In GERMAN Presented at the DGLR Symp. on Bodeneinrichtungen fuer Raumfahrzeuge, Munich, 12-13 Apr. 1972
(MBB-UA-56-72-O; DGLR-Paper-72-025) Avail: NTIS HC $3.00

A survey is given of the automatic flight control system, AOOSY, which was developed for and tested with the Azur satellite. Actual flight data are compared with the desirable data in the control center computer, and nonidentity leads to correction

commands. Improvements and extensions of the system are described. ESRO

N73-27184# Macon-Bibb County Planning and Zoning Commission, Ga.
COMMUNITY FACILITIES 1973-1978, MACON, GEORGIA Final Report, 1973 - 1978
Mar. 1973 106 p Sponsored by HUD
(PB-220030/1; PZ-73-01) Avail: NTIS HC $7.50 CSCL 13B

The purpose of the study is to evaluate the existing community facilities in the City of Macon and to make recommendations for improvements based on national standards or developing needs. The following areas are included: public safety, transportation, recreation and parks, libraries, public health, public buildings, and sanitation. (Author Modified Abstract) GRA

N73-27185# North Central Alabama Regional Council of Governments, Decatur.
HARTSELLE, ALABAMA, AIRPORT ZONING PROVISIONS: ROUNTREE FIELD
1972 44 p Sponsored by HUD
(PB-220087/1; ALA-NCA-0860-1009-01) Avail: NTIS HC $4.25 CSCL 13B

Proposed regulations are listed whose primary purpose is to promote safety in air navigation in utilizing the municipal airport of Hartselle, Alabama (Rountree Field). These proposed regulations are prepared in legal form, along with appropriate maps, for adoption and administration by the city as an addition to the existing Zoning Ordinance. Author (GRA)

N73-27186# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
EVALUATION OF KAISER MX19-B AND MX19-C ALUMINUM HONEYCOMB LANDING MAT
Gordon L. Carr and Dave A. Ellison Mar. 1973 57 p refs
(DA Proj. 1T0-62103-A-046)
(AD-758840; AEWES-Misc-Paper-S-73-11) Avail: NTIS CSCL 01/5

The report describes an investigation conducted to evaluate the MX19 aluminum honeycomb-core landing mat with modified male and female hinge-type connectors. The MX19 mat was a sandwich-type structure composed of an aluminum honeycomb core bonded by an adhesive to top and bottom aluminum sheets. The extruded aluminum edge connectors were welded to the sheets and bonded with adhesive to the core. The panels were joined along two edges by a hinge-type male/female connection. The adjacent edges were joined by an overlap/underlap connection secured by a locking bar. (Author Modified Abstract) GRA

N73-27187# CLM/Systems, Inc., Cambridge, Mass.
AIRPORTS AND THEIR ENVIRONMENT: A GUIDE TO ENVIRONMENTAL PLANNING Final Report, Oct. 1970 - Sep. 1972
Sep. 1972 524 p refs
(Contract DOT-OS-00059)
PB-219957/8; DDT-P-5600.1) Avail: NTIS HC $12.50 CSCL 13B

The report is designed to assist and guide airport planners, regional planners, and all other interested parties in identifying and resolving environmental problems associated with airport planning and development. It treats airport environmental planning as an integral part of the comprehensive regional planning process as this process is affected by the National Environmental Policy Act of 1969 and other relevant Federal legislation. It contains major chapters in the following: environmental planning process; aircraft noise; impacts on land use; air pollution; water pollution; hydrologic impacts; and ecologic impacts. GRA

N73-27188# Army Foreign Science and Technology Center, Charlottesville, Va.
CONSTRUCTION OF SPACE TRIANGULATION NETS BY CHORD DIRECTION AND DISTANCE
B. M. Klenitskii 1 Nov. 1972 12 p refs Transl. into ENGLISH from Byul. St. Optich. Nablyudeniya Iskusstv. Sputnikov Zemli (Moscow), no. 55, 1968 p 92-99
(AD-759096; FSTC-HT-23-896-72) Avail: NTIS CSCL 08/5

Consideration of an elementary figure making it possible to determine direction and length of a space triangulation chord by simultaneous photographic and Doppler observations from a satellite. A formula is suggested for a prior estimate of accuracy of chord length and, based on an analysis of it, recommendations are made about optimal dimensions and shape of the figure. A method is suggested for leveling the triangulation observations considered, by means of conditions with additional unknowns. Author (GRA)

N73-27189# Metcalf and Eddy, Inc., Boston, Mass.
ANALYSIS OF AIRPORT SOLID WASTES AND COLLECTION SYSTEMS: SAN FRANCISCO INTERNATIONAL AIRPORT Final Report
1973 149 p Prepared for San Francisco City and county Airports Comm., Calif.
(Grant EC-00294)
(PB-219372/0; EPA-SW-48D-73) Avail: NTIS HC $5.45 CSCL 13B

The study develops basic information on solid wastes generated at San Francisco International Airport and alternative collection, transfer, and transportation systems that might demonstrate engineering feasibility and economic benefit. The weight and composition of solid wastes were derived from field data gathered from passenger terminals, air freight areas, including mail service facilities, aircraft service centers, and aircraft maintenance bases. Questionnaires were sent to national airports to determine their operating levels and the levels were then compared to those at San Francisco to ascertain whether the data derived there would be applicable on a nationwide basis. The report describes two collection systems of potential economic benefit to the airport complex that were selected from various alternatives evaluated. GRA

N73-27190# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
EVALUATION OF REDESIGNED XW18 MEMBRANE AND ACCESSORIES Final Report, Mar. 1969 - Jan. 1970
Frank M. Palmer May 1973 127 p refs
(DA Proj. 1G6-64717-D-556)
(AD-761089; AEWES-TR-S-73-3) Avail: NTIS CSCL 01/5

Tests were conducted at the U. S. Army Engineer Waterways Experiment Station to determine the suitability of the redesigned XW18 membrane and accessories as expedient surfacing for waterproofing and dustproofing hastily prepared airfields for operations of C-130 aircraft. The objectives of the tests were as follows: to compare the redesigned XW18 membrane with the WX18 membrane, which was considered unsuitable as an expedient surfacing for C-130 operations as a result of integrated engineering and service tests conducted at Ft. Campbell, Kentucky, during 11 May to 15 November 1966, and to determine whether the XW18 membrane met the requirements of the Department of the Army approved Qualitative Materiel Requirement (QMR) for Prefabricated Airfield Surfacings. GRA

N73-27191# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONSTRUCTION AND MAINTENANCE OF AIRFIELDS
G. I. Glushkov and B. S. Raev-Bogoslovskii 22 Dec. 1972 468 p refs Transl. into ENGLISH of the book "Ustroystvo i Soderzhaniye Aerodromov" Moscow, 1970 p 1-318
(AD-759243; FTD-MT-24-544-72) Avail: NTIS CSCL 01/5

The manual contains the general requirements for airfields, information about their elements, and about the methods of operational maintenance and repair of flying field and basic airport installations. Special attention is given to the unsurfaced flying strips. The book examines contemporary constructions of hard and soft coverings, including concrete, reinforced, prestressed - monolithic and composite, asphalt-concrete and rough coverings made of crushed stone and gravel mixtures, and also sectional coverings. Snow and ice coverings on airfields are described. (Author Modified Abstract) GRA

N73-27192# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.
IOWA STATE AIRPORT SYSTEM PLAN. VOLUME 1: SUMMARY REPORT Final Report, 1971 - 1972
R. L. Carstens Nov. 1972 53 p Sponsored in part by FAA
(PB-217531/3; ISU-EIR-AMES-72249-1) Avail: NTIS HC $3.00 CSCL 13B

The report sets forth a State Airport System Plan (SASP) for Iowa and suggests means for implementing those actions necessary to develop such a system. The recommended system includes 117 airports. An appropriate expectation is that the designated system should better satisfy the economic and social goals of the State of Iowa than any alternative system, whether that alternative consists of the same number, a lessor number, or a greater number of airports. Author (GRA)

N73-27193# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.
IOWA STATE AIRCRAFT SYSTEM PLAN. VOLUME 2: TECHNICAL SUPPLEMENT Final Report, 1971 - 1972
R. L. Carstens Nov. 1972 424 p refs Sponsored in part by FAA
(PB-217532/1; ISU-ERI-AMES-72249-2) Avail: NTIS HC $6.00 CSCL 13B
For abstract, see N73-27192.

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N73-27194 National Lending Library for Science and Technology, Boston Spa (England).
INFLUENCE OF TURBULENCE IN THE FLOW OF FUEL GAS MIXTURES ON THE PROCESS OF IGNITION
S. A. Goldenberg and V. N. Ievlev Feb. 1973 8 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk, Mekhan. i Mashinostr. (Moscow), v. 4, 1963 p 112-115 (NLL-RTS-7883) Avail: £0.70; 2 NLL photocopy coupons

The influence of the degree of turbulence in the flow of a fuel gas mixture on the critical conditions for ignition by a flame source was investigated. The research was conducted on an apparatus consisting of a horizontal tubeburner approximately 30 millimeters in diameter and about 300 millimeters in length. A prepared gasoline-air mixture was fed into the burner at a prescribed velocity. The mixture was ignited by a flame source igniter lying along the axis of the burner. The flow turbulence was varied by means of turbulence promoting gratings which were installed in the burner tube at different distances from the end face. Author

N73-27195 Lehigh Univ., Bethlehem, Pa.
CONDENSATION EFFECTS IN NOZZLE FLOWS Ph.D. Thesis
Choon-Jiaw Shih 1972 156 p
Avail: Univ. Microfilms Order No. 73-4283

Condensation effects in supersonic nozzle flows are discussed. Both homogeneous and heterogeneous nucleation are considered, though most attention is given to the former case. Homogeneous nucleation is governed principally by two parameters, a growth rate lambda and a nucleation parameter K. (This latter parameter is an inverse measure of the activation energy). Heterogeneous nucleation depends only on a growth rate. Parameter expansions are developed for the asymptotic limit lambda approaches infinity. Lambda large implies that the time scale associated with the flow is much larger than the relaxation time for droplet growth. The correct expansion for homogeneous nucleation depends in detail on the magnitude of K. (K small implies that the nucleation rate (droplet production) is small etc.) Particular attention is given to the determination of conditions under which the collapse of the supersaturated state is governed by a condensation shock. Dissert. Abstr.

N73-27196 Washington Univ., Seattle.
THE BEHAVIOR OF A COMPRESSIBLE TURBULENT BOUNDARY LAYER IN SHOCK-WAVE-INDUCED ADVERSE PRESSURE GRADIENT Ph.D. Thesis
William C. Rose 1972 241 p
Avail: Univ. Microfilms Order No. 73-3778

The results of an experimental investigation of the mean-and fluctuating-flow properties of a compressible turbulent boundary layer in a shock-wave-induced adverse pressure gradient are presented. The turbulent boundary layer developed on the wall of an axially symmetric nozzle and test section whose nominal free-stream Mach number and boundary-layer thickness Reynolds number were 4 and 100,000, respectively. The adverse pressure gradient was induced by an externally generated conical shock wave. Mean and time-averaged fluctuating-flow data, including the complete experimental Reynolds stress tensor and experimental turbulent mass- and heat-transfer rates are presented for the boundary layer and external flow, upstream, within, and downstream of the pressure gradient. The mean-flow data include distributions of total temperature throughout the region of interest. The turbulent mixing properties of the flow were determined experimentally with a hot-wire anemometer. The calibration of the wires and the interpretation of the data are discussed. Dissert. Abstr.

N73-27197 Rhode Island Univ., Kingston.
TURBULENT THERMAL DIFFUSION OF A SLOT JET FLOWING INTO A MOVING STREAM Ph.D. Thesis
Alexander James Patton 1972 244 p
Avail: Univ. Microfilms Order No. 73-2381

An experimental and theoretical investigation of a submerged, turbulent, two-dimensional, heated slot jet flowing into a moving stream was made. Knowledge of the behavior of such a jet is of major importance in the plant siting of industries with thermal discharges and in the design of such discharges. An integral technique of analysis was used which assumes an entrainment mechanism based on the vector difference between the characteristic jet velocity and the ambient stream velocity. A gross force term is also assumed to act on the jet. The solution requires an entrainment coefficient and force coefficient, and predicts the jet trajectory, jet spread, velocity decay and temperature decay. The solution also assumes similarity of velocity profiles and density profiles with distance along the jet axis. Dissert. Abstr.

N73-27198 Oklahoma Univ., Norman.
THE SOLUTION OF LAMINAR NATURAL CONVECTION FLOWS IN RECTANGULAR ENCLOSURES BY THE METHOD OF MATCHED ASYMPTOTIC EXPANSIONS Ph.D. Thesis
Robert Joseph Krane 1972 140 p
Avail: Univ. Microfilms Order No. 73-4945

Laminar, natural convection flows of a Newtonian fluid in a two-dimensional rectangular enclosure are considered. The two vertical walls of the enclosure are assumed to be isothermal surfaces maintained at two different temperatures and the horizontal walls are assumed to be adiabatic surfaces. The physical nature of the flows in all regions of the flow-field, including the corners is explained for the first time. The crucial point of this part of the analysis is the determination of the correct force balance in the core. The resulting pressure force-buoyancy force balance gives the experimentally observed linear temperature profile in the core region. The vertical wall boundary layers are found to be govered by a second order set of nonlinear parabolic partial differential equations that are nonsimilar. The pseudo-elliptic zeroth-order behavior of completely enclosed natural convection flows is revealed for the first time. Dissert. Abstr.

N73-27199 Stanford Univ., Calif.
ELECTRONIC NONEQUILIBRIUM IN A SUPERSONIC EXPANSION OF IONIZED GAS Ph.D. Thesis
Douglas David McGregor 1972 283 p
Avail: Univ. Microfilms Order No. 73-4555

An experimental and analytical study of nonequilibrium among the populations of the excited levels of potassium vapor passing through a supersonic nozzle is presented. In the experiment a small amount of potassium vapor was injected into a flow of a mixture of argon and helium, heated by an arc jet electric discharge to a temperature of the order of 2500 K (at a pressure of 3 atmospheres). The resulting plasma (composed of electrons and potassium ions) was passed through a supersonic nozzle attaining a flow Mach number of approximately 2.2 at the nozzle exit. Spectroscopic measurements (line intensity and line reversal) of the gas were performed upstream of the nozzle and at the nozzle exit. Dissert. Abstr.

N73-27200 North Carolina State Univ., Raleigh.
INTERACTIONS OF RADIATION WITH CONDUCTIVE AND CONVECTIVE HEAT TRANSFER IN ABLATION AND BOUNDARY LAYER FLOW Ph.D. Thesis
Michael Alston Boles 1972 104 p
Avail: Univ. Microfilms Order No. 73-1874

The normal mode expansion technique is applied to solve the steady state heat transfer in ablation combined with radiation for an absorbing emitting, isotropically scattering, gray, semi-transparent, semi-infinite glassy material with externally applied constant heat flux at the boundary. The Fresnel reflection at the air-liquid interface is also included in the analysis. The effects of conduction-to-radiation parameter, single scattering albedo, surface reflectivity on the distribution of temperature and the radiative heat flux in the ablating medium are investigated. The same technique is utilized in the solution of the heat transfer for radiating boundary layer flow of an absorbing, emitting and scattering fluid over a wedge. Two cases considered influxed (a) compressible boundary layer flow over a flat plate with an adiabatic wall, and (b) incompressible boundary layer flow over a 90 deg wedge with prescribed wall temperatures. The temperature profiles, the radiative, and the total heat fluxes are evaluated for verious locations along the body. Dissert. Abstr.

N73-27201 Tulane Univ., New Orleans, La.
TRANSIENT THERMOCOUPLE INVESTIGATION OF ROCKET INJECTOR FACE FLOW FIELDS Ph.D. Thesis
Douglas Michael Boylan 1972 76 p
Avail: Univ. Microfilms Order No. 73-2185

The gas flow near the injector of a liquid propellant rocket was investigated by rapidly inserting butt-welded platinum-platinum rhodium thermocouples through the injector into the chamber. Preliminary tests yielded gas flow directions and gas composition at the injector face. The transient responses of the thermocouples were analyzed to determine average gas temperatures and velocities. A method of fitting exponential curves to repeated measurements of the transient temperature at several positions near the injector face produced consistent results. Average gas temperatures were found to be between 3100 and 3500 F, and the average gas velocities between 550 and 840 feet/second. Dissert. Abstr.

N73-27202 Colorado State Univ., Fort Collins.
RESPONSE OF A TURBULENT BOUNDARY LAYER TO LATERAL ROUGHNESS DISCONTINUITIES Ph.D. Thesis
Hua Wang 1972 172 p
Avail: Univ. Microfilms Order No. 73-2825

The structure of the turbulent boundary layer on a flat plate consisting of alternate, longitudinal strips of smooth and rough surfaces parallel to the direction of the flow was investigated experimentally in a wind tunnel. The width of these strips was chosen to be equal. The streamwise pressure gradient in the free stream was adjusted so as to be nearly zero. The experimental investigation was limited to one type of surface configuration with the free-stream velocity as the only variable. Measurements of mean velocity, wall shear stress, turbulent intensities, turbulent shear stresses and energy spectra of the streamwise turbulent velocity were obtained. Dissert. Abstr.

N73-27203 Ohio State Univ., Columbus.
A VISUAL STUDY OF TURBULENT SHEAR FLOW Ph.D. Thesis
Stavros George Nychas 1972 206 p
Avail: Univ. Microfilms Order No. 73-2090

A visual study was conducted of the outer region of a turbulent boundary layer along a flat plate; in addition, limited observations of the wall area was also made. The technique involved suspending very small solid particles in water and photographing their motions with a high speed camera moving with the flow (convected view). The method was basically the same as used by Corino and Brodkey to study the wall area of turbulent pipe flow. The emphasis of the study was on visual observations of individual motions occurring in the flow; some velocity measurements and estimations of Reynolds stresses were also made. The visual observations and velocity measurements presented new insight to the puzzling questions concerning the connection and interaction of the wall and the outer regions in a turbulent boundary layer. They also provided a basic physical picture of the processes for further model studies. Dissert. Abstr.

N73-27204 Illinois Inst. of Tech., Chicago.
NUMERICAL SOLUTION OF DRIVEN VORTICES OF BINARY FLUID IN CYLINDRICAL GEOMETRY Ph.D. Thesis
Yong Woo Shin 1972 173 p
Avail: Univ. Microfilms Order No. 73-3640

The steady state laminar motion of a viscous, incompressible and binary fluid is studied for a rotating flow in a cylindrical geometry. The mathematical model employed is a cold flow simulation of the Light-Bulb concept of the gaseous core nuclear engine. The radial inward convection of angular momentum of the coolant gas through the porous periphery drives the vortex, mixes with the fuel gas and eventually leaves the chamber as a mixture through a small exit hole on one end wall. The fuel gas addition is mathematically simulated by an interior mass source. A new computation method is presented to account for the interior mass addition. The method uses a potential function in addition to the stream function and vorticity used in current methods for solving viscous incompressible flows.
Dissert. Abstr.

N73-27205 Oklahoma Univ., Norman.
RECOGNITION OF DISPERSION AND CONVECTION PATTERNS OF TRANSPORT PHENOMENA IN STATIONARY AND NONSTATIONARY FLUIDS Ph.D. Thesis
James Briscoe Stephens 1972 148 p
Avail: Univ. Microfilms Order No. 73-4970

Algorithms were developed which permit the separation and consistent interpretation of the simultaneously occurring kinematics -- convection and dispersion -- associated with statistically stationary and nonstationary fluid transport. The separation of the fluid kinematics of the transport process poses both an experimental problem and an analytical problem. The experimental problem is to retrieve sufficiently detailed local information for a field description of the scalar quantities without introducing probe interference on the field or the modes of transport. The soluting utilized was to employ radiometers to remotely sense a local flow field by crossed beam triangulation. The temporal information thus retrieved contains the signature of the space-time variations of the transmission coefficients. The analytical problem is to extract a description of the transport kinematics in terms of the field parameters that are related to the accepted description of turbulence flows. Dissert. Abstr.

N73-27206# Aeronautical Research Inst. of Sweden, Stockholm.
PRESSURE DISTRIBUTION ON A PLANE GROUND SURFACE CAUSED BY A SUBSONIC AIRCRAFT
Bo Johansson Dec. 1970 43 p ref
(FFA-AU-634-Pt-2) Avail: NTIS HC $4.25

An analytic investigation has been made of the pressure distribution on a plane ground surface under an aircraft flying at low altitude with subsonic velocity. The effects of the volume and the lift of the aircraft on the pressure distribution have been considered. The aircraft volume has been represented by an ovoid and the lift by a vortex of constant strength and two trailing tip vortices. The volume and lift components of this pressure distribution have furthermore been expanded in power series in the ratios of the aircraft dimensions to the flight altitude. As a numerical example, a fighter aircraft, flying at the Mach numbers 0.8, 0.9 and 0.97 and at the altitudes 25, 50, 100 and 200 meters, has been considered. Author

N73-27207*# Hamilton Standard, Windsor Locks, Conn.
NOISE AND WAKE STRUCTURE MEASUREMENTS IN A SUBSONIC TIP SPEED FAN: TABULATION AND PLOTS OF TEST DATA
B. Magliozzi, B. V. Johnson, D. B. Hanson, and F. B. Metzger
23 Jul. 1973 284 p
(Contract NAS1-11670)
(NASA-CR-132259) Avail: NTIS HC $16.25 CSCL 20D

Noise and wake structure measurements in a ducted fan were conducted. The tip speed was kept at subsonic levels. The anechoic platform used during the test is described. The following conditions are reported: (1) one third octave band analyses of the fan noise data, (2) narrow band analyses of the fan noise

for selected test conditions, (3) narrow band sound power level data for all fan test conditions, and (4) velocity and air angle evaluation of blade wake data. Author

N73-27208*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TABLES FOR SUPERSONIC FLOW OF HELIUM AROUND RIGHT CIRCULAR CONES AT ZERO ANGLE OF ATTACK
Joseph L. Sims Washington 1973 28 p refs
(NASA-SP-3078; LC-73-600000) Avail: NTIS MF $0.95; SOD HC $2.45 Domestic Postpaid or, HC $2.25 GPO Bookstore CSCL 20D

The results of the calculation of supersonic flow of helium about right circular cones at zero angle of attack are presented in tabular form. The calculations were performed using the Taylor-Maccoll theory. Numerical integrations were performed using a Runge-Kutta method for second-order differential equations. Results were obtained for cone angles from 2.5 to 30 degrees in regular increments of 2.5 degrees. In all calculations the desired free-stream Mach number was obtained to five or more significant figures. Author

N73-27209*# Kanner (Leo) Associates, Redwood City, Calif.
CALCULATION OF POTENTIAL FLOW AROUND PROFILES WITH SUCTION AND BLOWING
K. Jacob Washington NASA Jul. 1973 34 p refs Transl. into ENGLISH from Ing.-Arch. (Berlin), v. 32, no. 1, 1963 p 51-65
(Contract NASw-2481)
(NASA-TT-F-14962) Avail: NTIS HC $3.75 CSCL 20D

A method of computation was developed for computing plane incompressible potential flows around arbitrary thick, cambered profiles with continuous or discontinuous blowing or suction. It works with source and vortex distributions on the contour and in the interior of the profile. An integral equation for the vortex distribution on the contour of the profile is arrived at, the solution of which is reduced to a linear set of equations. Finally, the method yields the velocity and pressure distribution on the contour of the profile and the flow stream function for plotting the flow pattern. The practicability of the method was established for the circular cylinder by comparing the velocity distribution with the exact solution, and on some thick, cambered profiles by comparison of the theoretical pressure distribution with measurements. Author

N73-27210*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
SOLUTION OF NON-ISOENERGETIC SUPERSONIC FLOWS BY METHOD OF CHARACTERISTICS, VOLUME 3 Final Report
R. J. Prozan Jan. 1972 74 p
(Contract NAS7-761)
(NASA-CR-132274; HREC-7761-3-Rev-A; LMSC/HREC-D162220-Vol-3-Rev-A) Avail: NTIS HC $5.75 CSCL 20D

The calculation of supersonic flow fields by the method of characteristics. The theoretical approach to the solution of these flow fields and a computer program to implement the numerical solution of the flow equations are discussed. This versatile program has a flexible set of boundary conditions enabling the calculation of nozzles, plumes and many other complex flow fields. A complete derivation of the equations of motion for reacting gas systems is presented. An important consequence of this derivation is that, for the reaction assumptions which were made, the thermochemistry was shown to be uncoupled from the flow solution and as such could be solved separately. The methods of characteristics equations are shown to be formally the same for ideal, frozen, and equilibrium reacting gas mixtures. Author

N73-27211*# Grumman Aerospace Corp., Bethpage, N.Y.
DEVELOPMENT OF ANALYTICAL METHODS OF PREDICTING THE PRESSURE DISTRIBUTION ABOUT A NACELLE AT TRANSONIC SPEEDS: EXACT SOLUTION Final Report
Bernard Grossman and Gino Moretti Jul. 1973 153 p refs
(Contract NAS1-10803)
(NASA-CR-112271) Avail: NTIS HC $9.75 CSCL 20D

A computer program to predict the inviscid, transonic flow field about isolated nacelles was developed. The problem was to be formulated to solve Euler's equations without any approximation (such as small disturbances) and hence the terminology exact solution. The flow field was complicated by the presence of imbedded shock waves, an engine-inlet interface, and exhaust plumes. Furthermore, the transonic nacelles of interest had a very slender but blunt cowl lip. This created two distinct length scales, the length of the nacelle and the cowl lip radius that can differ by several orders of magnitude. These aspects of the flow field presented many numerical difficulties. The approach to the problem was to calculate the nacelle flow field using the method of time-dependent computations (TDC). Although at the time of the issuance of this contract, other approaches to transonic flow calculations existed, it was felt that TDC offered the most effective means of meeting the goals of the contract. Author

N73-27212# National Aerospace Lab., Tokyo (Japan).
A NUMERICAL CALCULATION OF A TWO-DIMENSIONAL INCOMPRESSIBLE POTENTIAL FLOW AROUND A SET OF AIRFOILS APPLYING THE RELAXATION METHOD
Masayoshi Nakamura Jan. 1973 14 p refs In JAPANESE; ENGLISH summary
(NAL-TR-309) Avail: NTIS HC $3.00

An application of the relaxation method to the two-dimensional incompressible potential flow around a system of arbitrary airfoils is described. The governing equation is the Laplace's (two-dimensional partial differential) equation of the stream function. This equation is solved in a boundary value problem of the Dirichlet-Neumann type. For numerical solution, some difference equations of the square meshes are used instead of the differential equation. The stream function is calculated numerically by solving those difference equations. The values of boundary condition are given on a certain finite distance from the airfoils. And the boundary value on each surface of the airfoils is varied to satisfy the Joukowski's condition. For example, a flow around an airfoil with a leading-edge slat and a slotted flap is calculated. The result is compared with other numerical solutions and experimental data. Author

N73-27213*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FREE TURBULENT SHEAR FLOWS. VOLUME 2: SUMMARY OF DATA
Stanley F. Birch Washington 1973 94 p Conf. held at Hampton, Va., 20-21 Jul. 1972
(NASA-SP-321) Avail: NTIS HC $3.00 CSCL 20D

The proceedings of a conference on free turbulent shear flows are presented. Objectives of the conference are as follows: (1) collect and process data for a variety of free mixing problems, (2) assess present theoretical capability for predicting mean velocity, concentration, and temperature distributions in free turbulent flows, (3) identify and recommend experimental studies to advance knowledge of free shear flows, and (4) increase understanding of basic turbulent mixing process for application to free shear flows. Examples of specific cases of jet flow are included. Author

N73-27214*# McDonnell-Douglas Corp., Long Beach, Calif.
SOME PROBLEMS OF THE CALCULATION OF THREE-DIMENSIONAL BOUNDARY LAYER FLOWS ON GENERAL CONFIGURATIONS
Tuncer Cebeci, Kalle Kaups, G. J. Mosinskis, and J. A. Rehn Washington NASA Jul. 1973 57 p refs
(Contract NAS1-11623)
(NASA-CR-2285) Avail: NTIS HC $3.00 CSCL 20D

An accurate solution of the three-dimensional boundary layer equations over general configurations such as those encountered in aircraft and space shuttle design requires a very efficient, fast, and accurate numerical method with suitable turbulence models for the Reynolds stresses. The efficiency, speed, and accuracy of a three-dimensional numerical method together with the turbulence models for the Reynolds stresses are examined. The numerical method is the implicit two-point finite difference approach (Box Method) developed by Keller and applied to the boundary layer equations by Keller and Cebeci. In addition, a study of some of the problems that may arise in the solution of these equations for three-dimensional boundary layer flows over general configurations. Author

N73-27215*# Pratt and Whitney Aircraft, East Hartford, Conn.
APPLICATION OF HOLOGRAPHY TO THE DETERMINATION OF FLOW CONDITIONS WITHIN THE ROTATING BLADE ROW OF A COMPRESSOR
R. G. Hantman, R. J. Burr, W. G. Alwang, and M. C. Williams Jul. 1973 114 p refs
(Contract NAS3-15340)
(NASA-CR-121112; PWA-4712) Avail: NTIS HC $7.75 CSCL 20D

The double-pulse, double-exposure holography technique was applied to visualize the flow field within a transonic compressor rotor with a tip speed of 1800 ft/sec. The principal objective was to visualize the shock waves created in the flow field which was supersonic relative to the rotating blade row. The upstream rotor blade bow shocks and, at high speed, the outermost portion of the leading edge passage shock were successfully observed in the holograms. Techniques were devised for locating these shocks in three dimensions, and the results were compared with theoretical predictions. Density changes between the two pulses due to motion of the shocks were large and, therefore, it was not possible to resolve the fringe systems in detail for the 100% speed conditions. However, gross features of the shocks were easily observed, and the upstream shocks were well displayed. In all cases the shock angles were somewhat larger than predicted by theory, and a distinct increase in angle near the outer wall was observed, which may be attributed to endwall boundary layer effects. The location and orientation of the observed leading edge passage shocks were in good agreement with static pressure contours obtained from measurements in the outer casing over the rotor tip. Author

N73-27216*# California Univ., Santa Barbara.
LASER DOPPLER VELOCITY MEASUREMENTS OF SWIRLING FLOWS WITH UPSTREAM INFLUENCE
Kenneth L. Rloff and Hartmut H. Bossel Washington NASA Jul. 1973 44 p refs
(Grant NGR-05-010-025)
(NASA-CR-2284) Avail: NTIS HC $3.00 CSCL 20D

Swirling flow in a rotating tube is studied by flow visualization at a moderate Reynolds number, and its velocity field is measured by laser-Doppler anemometry. The tube has constant diameter, and approximately uniform initial rigid rotation of the flow is assured by passing the flow through a rotating plug of porous metal before it enters the test section. At moderate swirl values, an object mounted on the tube centerline causes a closed bubble to form upstream of the obstacle, with a clearly defined stagnation point on the axis, and recirculating flow inside the bubble. The bubble length grows upstream as the swirl is increased, until it breaks up into a Taylor column reaching all the way upstream and downstream at swirl values above a certain critical value. A vortex jump (in the sense of Benjamin) occurs downstream of the obstacle except when the Taylor column is present. Using a laser-Doppler anemometer, axial and swirl velocity profiles are obtained at several stations upstream and downstream of the bubble, and in and around the bubble. Author

N73-27217*# Kanner (Leo) Associates, Redwood City, Calif.
EXPERIMENTAL DETERMINATION OF BOUND VORTEX LINES AND FLOW IN THE VICINITY OF THE TRAILING EDGE OF A SLENDER DELTA WING
D. Hummel and G. Redeker Washington NASA Aug. 1973 24 p refs Transl. into ENGLISH of "Experimentelle Bestimmung der gebundenen Wirbellinien sowie des Stroemungsverlaufs in der Umgebung der Hinterkante eines schlanken Deltafluegels", Braunschweigische Wissenschaftlich Gesellschaft, Abhandungen, 1972 p 273-290
(Contract NASw-2481)
(NASA-TT-F-15012) Avail: NTIS HC $3.25 CSCL 20D

Boundary layer measurements were carried out on a sharp-edged delta wing (Aspect ratio = 1.0, angle of incidence = 20.5) with turbulent boundary layers. From the velocities at the outer edge of the boundary layer on the upper and the lower side of the wing the bound vortex lines in the lifting surface were determined. A comparison with former investigations concerning laminar boundary layers shows the influence of the status of the boundary layer on vortex formation. Studies on the flow downstream from the wing trailing-edge indicate that the trailing vortex sheet rolls up into a vortex, the rotation of which is opposite to that of the leading-edge vortex. The axis of this so-called trailing edge vortex forms a spiral within the leading-edge vortex. Author

N73-27218# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
INTERACTION OF SPHERICAL SOURCE FLOW AND AXISYMMETRIC FREE JET WITH A RAREFIED BACKGROUND
Prem K. Khosla May 1972 16 p refs
(Contract DAHC04-69-C-0077; ARPA Order 1442)
(AD-761149; PIBAL-72-25) Avail: NTIS CSCL 20/4

The interaction of a hypersonic source flow and an axisymmetric free jet with a rarefied background is investigated. Based on the singular nature of the distribution function, the Boltzmann equation is split into two kinetic equations. This approach includes the basis for the beam-continuum method as a special case. Application of the simple moment method leads to a closed form solution for the results arrived at by Muntz, Hamel and Maguire for source flow. The solution for the axisymmetric free jet also agrees with the experimental results due to Brook, Hamel and Muntz. Author (GRA)

N73-27219# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
THOUGHTS AND AFTERTHOUGHTS ABOUT SHOCK COMPUTATIONS
Gino Moretti Dec. 1972 90 p refs
(Contract N00014-67-A-0438-0009; NR Proj. 061-135)
(AD-760015; PIBAL-72-37) Avail: NTIS CSCL 20/4

Typical one-dimensional, unsteady flow problems are considered to support shock-fitting concepts as the best way to handle shocked flows. Shock-capturing experiments are discussed; their results are concluded to be unsatisfactory. Various methods to predict the formation of a shock are suggested. Four shock-fitting methods are discussed, two of them considering the shock as a boundary between regions of continuous flow and two letting the shock move between mesh points.
Author (GRA)

N73-27220# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
INVESTIGATION OF THE KINEMATIC AND DYNAMIC CHARACTERISTICS IN THE WAKE BEHIND A FLAT PLATE PLACED NORMAL TO A PARALLEL UNBOUNDED FLOW
M. S. Fomichev 28 Feb. 1973 20 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Energ. i Transp. (Moscow), no. 4, 1972 p 135-144
(Contract N00017-72-C-4401)
(AD-761372; APL-CLB-3-T-655) Avail: NTIS CSCL 20/4

The kinematic and dynamic characteristics of the wake fully developed turbulent flow behind a flat plate placed normal to an approaching uniform flow are examined. The investigation was carried out by the motion-picture flow visualization method, by capacitance sensors to measure the dynamic pressure fluctuations, and by thermoanemometers to measure the velocity fluctuations. The relationship between the average and fluctuation kinematic and dynamic characteristics is defined in dimensionless form, and an approximate computational formula is derived. (Author Modified Abstract) GRA

N73-27221# Grumman Aerospace Corp., Bethpage, N.Y.
OPTIMIZATION OF FORWARD FOIL LIFT CONTROL FOR AG(EH) HYDROFOIL CRAFT. VOLUME 1: HYDRODYNAMICS Interim Report, Mar. 1971 - Oct. 1972
Howard R. Wright, Jr. Dec. 1972 354 p refs
(Contract N00014-71-C-0160)
(AD-760684; HCG-72-19(1)) Avail: NTIS CSCL 13/10

The report presents the foil and craft characteristics required by the Grumman Specific Linear Optimal Control Program for hydrofoil craft (SLOCOP). The characteristics are presented in generalized form, compared with certain experimental measurements, and evaluated for the AG(EH). The prediction confidence level is deficient in three significant areas: hinge moment, particularly for flaps; unsteady loading, particularly for orbital motion; and flap cavitation boundaries. SLOCOP trending studies are underway to establish the sensitivity of the autopilot design to the unsteady loading representation employed. These studies

are intended to identify those unsteady loading responses for which further experimental effort is required for confident autopilot design. Author (GRA)

N73-27222# Naval Intelligence Support Center, Washington, D.C. Transl. Div.
WEIGHT CHARACTERISTICS OF HULLS AND FOIL SYSTEMS OF HYDROFOIL CRAFT
B. P. Kuzovenkov 30 May 1973 12 p refs Transl. into ENGLISH from Sudostroenie (USSR), no. 7, 1969 p 17-19
(AD-761123; NISC-Trans-3431) Avail: NTIS CSCL 13/10

The report briefly describes the selection of materials used for hydrofoil craft construction in order to reduce structural weight and optimize payloads. GRA

N73-27223# Notre Dame Univ., Ind. Dept. of Aerospace and Mechanical Engineering.
A NEW PHENOMENOLOGICAL APPROACH TO THE TURBULENT SHEAR FLOWS
Yi Lin Chen and V. W. Nee Oct. 1972 106 p refs
(Grant AF-AFOSR-1929-70; AF Proj. 9781)
(AD-760765; AFOSR-73-0857TR) Avail: NTIS CSCL 20/4

A general turbulent shear flow theory is developed here applicable to both wall turbulent shear flow as well as the free turbulent shear flow. This theory is essentially based on the establishment of a rate equation for the Reynolds stress obtained from a simple dimensional analysis of the important flow characteristics. This equation, together with the mean equations of motion form a hyperbolic system. Numerical integrations by the method of characteristics have been employed to obtain deailed solutions. For the time being, the present theory has been applied to various flow cases such as the turbulent boundary layer with various pressure gradients, the turbulent wake after a trailing edge as well as the flow near separation. Author (GRA)

N73-27224# Technology, Inc., Dayton, Ohio.
A RE-EXAMINATION OF THE JUNCTURE BETWEEN THE SONIC LINE AND A SHOCK IN FLOWS WITH FREE STREAM M < 1 Final Report
Karl G. Guderley and Y. V. G. Acharya May 1973 51 p refs
(Contract F33615-71-C-1463; AF Proj. 7071)
(AD-760801; ARL-73-0066) Avail: NTIS CSCL 20/4

A possibility that the flow field at the juncture of the sonic line and a shock in flows with high subsonic Mach numbers can be described by a similarity solution is examined in detail. For physical reasons singularities propagating in the supersonic region towards the point of junction are excluded. A heuristic argument is made showing why similarity solutions are unlikely. The essential features of flow patterns computed by Nocilla are described. (Author Modified Abstract) GRA

N73-27225# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
CAVITATION AND CAVITATION DAMAGE
Milton S. Plesset Mar. 1973 22 p refs
(Contract N00014-67-A-0094-0009)
(AD-760719) Avail: NTIS CSCL 20/4

The general features of the growth of cavitation bubbles and of boiling bubbles are described, and explicit formulas are presented for limiting cases of interest. The analytical features of cavitation bubble collapse are also presented. In the discussion of cavitation damage, the results of the effect of the temperature of the cavitating liquid are reviewed as are the effects of changing liquid composition. The theory of the formation of a liquid jet in bubble collapse is described. The relevance of this jet formation for cavitation damage is emphasized. Author (GRA)

N73-27226# Grumman Aerospace Corp., Bethpage, N.Y.
OPTIMIZATION OF FORWARD FOIL LIFT CONTROL FOR AG(EH) HYDROFOIL CRAFT. VOLUME 2: CONTROL Interim Report, Mar. 1971 - Oct. 1972
Roderick M. Rose Dec. 1972 92 p refs
(Contract N00014-71-C-0160)
(AD-760698; HCG-72-19(2)-Vol-2) Avail: NTIS CSCL 13/10

The report summarizes the development, to date, of a linear optimal plant plus controller model for hydrofoil craft. Optimization relative to quadratic performance indices is performed on a control system using restricted state feedback. Application is made to an AG(EH) longitudinal control system with fixed pitch and height gains. The model is driven by a discretized two dimensional Pierson-Moskowitz sea (steady wind of 26 kts) comprised of 13 spectral components. Vehicle responses and control system gains are trended relative to craft speed and heading for fixed sea state. Implications regarding control system structure are reviewed. Author (GRA)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N73-27227 Wisconsin Univ., Madison.
AIRBORNE LIDAR MEASUREMENTS OF THE STRATOSPHERIC AEROSOL Ph.D. Thesis
Robert Joseph Fox 1972 136 p
Avail: Univ. Microfilms Order No. 72-31528

Stratospheric backscattering measurements were made using an airborne lidar system. This system, consisting of a dye lasar operating at 585 nm, a Newtonian receiver employing fresnel optics, and a digital data logging system, was flown aboard the NASA Convair 990 jet laboratory. More than 16,000 stratospheric backscattering returns were collected on four flights over the Pacific Ocean south of Hawaii during August, 1971, and two flights between Wallops Island, Virginia, and Bermuda, in September, 1971. Scattering ratios (= 585 nm) varied between 1.0 and 1.1 + or - 0.1 at altitudes of 15 - 35 km, with no well-defined scattering layers present in the Pacific or Atlantic experimental areas in either consecutively or meridionally averaged data. Dissert. Abstr.

N73-27228 North Carolina Univ., Chapel Hill.
INVESTIGATION OF THE BEHAVIOR OF OZONE AND NITRIC OXIDE IN THE LOWER TROPOSPHERE Ph.D. Thesis
Lawrence David Kornreich 1972 119 p
Avail: Univ. Microfilms Order No. 73-4848

The rapid reaction between nitric oxide (NO) and ozone (O3) precludes to measurement of both gases in the atmosphere for any extended period of time, particularly during the nighttime hours when photochemical synthetic processes are inactive. Three possible explanations for the simultaneous measurement of NO and O3 were investigated, using measurement techniques specific for both gases. Laboratory investigation and previous kinetic studies and empirical observations confirmed the reported value of the rate constant for the reaction between NO and O3. Chemical interference with the method used for the measurement of NO from typical compounds found in polluted air was ruled out on the basis of their nonreactivity with the analytical reagent, and the absence of detectable concentrations in polluted air. Dissert. Abstr.

N73-27229 California Univ., San Diego.
DYNAMICAL PROBLEMS IN THE EARTH'S POLAR IONOSPHERE Ph.D. Thesis
Joel Albert Fedder 1972 154 p
Avail: Univ. Microfilms Order No. 73-4419

A selection of problems concerning plasma and neutral atmospheric motion in the earth's polar ionosphere are presented. The importance of magnetospheric electric fields in creating a thermospheric wind system through ion drag in the polar ionosphere is demonstrated. A theory for the generation of auroral infrasonic waves by supersonic motion of an auroral arc associated electrojet is developed from the linearized steady state hydrodynamic equations. Kinetic and hydrodynamic models of a collisionless ion-exosphere are developed. The results of calculations from the two models are compared and are found to be in good agreement. Dissert. Abstr.

N73-27230 Kansas Univ., Lawrence.
MAGNETIC FIELDS AND PARTICLE CURRENTS IN THE GEOMAGNETIC TAIL Ph.D. Thesis
Michael Keith Bird 1972 228 p

Avail: Univ. Microfilms Order No. 73-1846

A magnetic field and current configuration which is magnetohydrodynamically and adiabatically self-consistent is constructed with the boundary conditions expected to hold in the geomagnetic tail. This field/current configuration is compared with the real magnetotail as observed by satellite. The fields and currents are said to be self-consistent in this sense if the contributions from all drift and magnetization currents form a current which is given at all points. A hypothesized current density for the neutral sheet of the magnetotail and all magnetotail surface currents was formulated from satellite observations and symmetry considerations. The current was assumed to have a midnight meridian plane profile that corresponds to the less complicated two-dimensional problem. Dissert. Abstr.

N73-27231 International Geophysical Year World Data Center A, Asheville, N.C.

AURORAL ELECTROJET MAGNETIC ACTIVITY INDICES (AE) FOR 1970

Joe Haskell Allen Nov. 1972 149 p refs

(UAG-22) Avail: National Climatic Center, Federal Building, Asheville, N. C. 28801 Attn: Publications HC $0.75

The auroral electrojet index (AE) is discussed and a detailed description is given of the derivation of 2.5-min AE indices for 1970. Tables are given of hourly average indices for each day of the year and of the stations which supplied the extreme deviations from quiet time levels for each hour. Graphs of the variations of the indices are included for each day. Author

N73-27232 Alaska Univ., College.

THE AURORAL OVAL AND THE HIGH LATITUDE IONOSPHERE Ph.D. Thesis

Arnold Lee Snyder, Jr. 1972 204 p

Avail: Univ. Microfilms Order No. 73-4293

The morphology of the high latitude winter ionosphere during magnetospheric substorms is examined. It is hypothesized that there exist relationships between synoptic scale ionospheric disturbances and the dynamics of the auroral oval during magnetospheric substorms. Ionograms, magnetic meridian all-sky camera films and magnetograms form the data base for these studies. As a first step, all-sky camera data from the Alaskan meridian chain of observatories are studied to determine the meridional distributions and motions of auroras that comprise the auroral oval. The results of this investigation reveal several new morphological features of the auroral substorm: (1) An enhanced equatorward drift of auroral forms and the clearing of the poleward sky result in an equatorward thinning of the auroral oval prior to the onset of the expansive phase of the substorm. (2) During worldwide magnetoquiet, intense auroral substorms can occur on the contracted auroral oval. Dissert. Abstr.

N73-27233 Colorado Univ., Boulder.

OZONE PHOTOCHEMISTRY AND ENERGY BUDGET IN THE MIDDLE ATMOSPHERE Ph.D. Thesis

Jae-Hyoung Park 1972 200 p

Avail: Univ. Microfilms Order No. 73-1813

The distributions of minor atmospheric constituents, principally O3 and O(P-3), and their contributions to the energy sources and sinks in the earth's middle atmosphere (10 to 100 km) are investigated. The photochemical mechanisms for the existence of minor constituents in a wet atmosphere, particularly of O3, O(P-3), H, and OH, are described. The photochemical relaxation times of these species are computed and compared with the time scale associated with atmospheric motions. It is found that in the region between 40 and 80 km the daytime distributions of these minor species, except for H2O and H2, can be computed by pure photochemistry. It is also found that the distributions of O3 in the region below 40 km and of O(P-3) and H in the region above 80 km need to be determined by a combination of photochemical and atmospheric transport processes. Particular attention is given to absorption of solar radiation by O2 in the O2 Schumann-Runge bands. Dissert. Abstr.

N73-27234*# Service de la Carte de la Vegetation CNRS, Toulouse (France).

MANAGEMENT OF NATURAL RESOURCES THROUGH AUTOMATIC CARTOGRAPHIC INVENTORY Progress Report, Aug. 1972 - Jan. 1973

Paul-Augustin Rey, Yves Gourinard, and Francis Cambou, Principal Investigators May 1973 80 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(E73-10725; NASA-CR-133069) Avail: NTIS HC $6.00 CSCL 08B

The author has identified the following significant results. Significant results of the ARNICA program from August 1972 - January 1973 have been: (1) establishment of image to object correspondence codes for all types of soil use and forestry in northern Spain; (2) establishment of a transfer procedure between qualitative (remote identification and remote interpretation) and quantitative (numerization, storage, automatic statistical cartography) use of images; (3) organization of microdensitometric data processing and automatic cartography software; and (4) development of a system for measuring reflectance simultaneous with imagery.

N73-27235*# Mississippi Test Facility, Bay St. Louis.

EVALUATION OF SATELLITE REMOTE SENSING AND AUTOMATIC DATA TECHNIQUES FOR CHARACTERIZATION OF WETLANDS AND MARSHLANDS Progress Report

Robert H. Cartmill, Principal Investigator 3 Jul. 1973 2 p ERTS

(E73-10740; NASA-TM-X-69168) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-27236*# Calspan Corp., Buffalo, N.Y.

S190 INTERPRETATION TECHNIQUES DEVELOPMENT AND APPLICATION TO NEW YORK STATE WATER RESOURCES Quarterly Report, 6 Mar. - 31 May 1973

Kenneth R. Piech, Principal Investigator 31 May 1973 6 p refs EREP

(Contract NAS9-13336)

(E73-10744; NASA-CR-133112; QR-1) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-27237*# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.

INVENTORY OF FOREST AND RANGELAND RESOURCES, INCLUDING FOREST STRESS Monthly Progress Report, 15 May - 15 Jun. 1973

Robert C. Heller, Robert C. Aldrich, Frederick P. Weber, and Richard S. Driscoll, Principal Investigators 15 Jun. 1973 6 p Sponsored by NASA EREP

(E73-10749; NASA-CR-133117; MPR-2) Avail: NTIS HC $3.00 CSCL 02F

There are no author-identified significant results in this report.

N73-27238*# South Dakota State Univ., Brookings.

[SKYLAB ORBITS] Monthly Report, period ending 1 Jun. 1973

Victor I. Myers, Principal Investigator 20 Jul. 1973 2 p EREP

(Contract NAS9-13337)

(E73-10756; NASA-CR-133124) Avail: NTIS HC $3.00 CSCL 22C

There are no author-identified significant results in this report.

N73-27239*# Ohio Dept. of Economic and Community Development, Columbus.

[COLLECTION OF OHIO GROUND TRUTH DATA FOR SKYLAB EREP] Quarterly Progress Report, Apr. - Jun. 1973

David C. Sweet, Principal Investigator Jun. 1973 2 p EREP (NASA Order C-21372-C)

(E73-10757; NASA-CR-133125) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-27240*# Kansas Univ. Center for Research, Inc., Lawrence.
INFLUENCE OF ATMOSPHERE PATHLENGTHS FOR DIFFERENT BANDS
Robert M. Haralick, Principal Investigator and K. Sam Shaumugan 9 Jan. 1973 2 p ERTS
(Contract NAS5-21822)
(E73-10763; NASA-CR-132205) Avail: NTIS HC $3.00 CSCL 04A

The author has identified the following significant results. Comparison of ERTS-1 imagery in three bands (MSS-4, 5, and 7) acquired over southwestern Kansas on 1 Dec. 72 reveals that low solar altitude has a pronounced different effect on apparent scene illumination in different bands.

N73-27241*# Kansas Univ. Center for Research, Inc., Lawrence.
AREA MEASUREMENT OF LAND USE CATEGORIES IN FINNEY COUNTY, KANSAS
Robert M. Haralick, Principal Investigator 24 Jan. 1973 5 p ERTS
(Contract NAS5-21822)
(E73-10764; NASA-CR-132206) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-27242*# Environmental Research Inst. of Michigan, Ann Arbor.
DEVELOPING PROCESSING TECHNIQUES FOR SKYLAB DATA Monthly Report, 8-30 Apr. 1973
Richard F. Nalepka, Principal Investigator 18 May 1973 1 p EREP
(Contract NAS9-13280)
(E73-10765; NASA-CR-133132; Rept-101900-4-L; MR-2) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-27243*# Grumman Ecosystems Corp., Bethpage, N.Y.
VIRGIN ISLANDS ERTS-1 EXPERIMENT Progress Report, Feb. - Mar. 1973
W. C. Coulbourn, Principal Investigator 23 Apr. 1973 3 p ERTS
(Contract NAS5-21811)
(E73-10767; NASA-CR-133164; GEC73L-295) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-27244*# Kansas Univ. Center for Research, Inc., Lawrence.
GRID MANAGEMENT OF SMALL WATER BODIES
H. L. Yarger, Principal Investigator 8 Feb. 1973 5 p ERTS
(Contract NAS5-21822)
(E73-10768; NASA-CR-133135) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-27245*# Rockwell International Science Center, Thousand Oaks, Calif.
SEISMICITY AND RECENT FAULTING IN EASTERN CALIFORNIA AND WESTERN AND CENTRAL NEVADA: A PRELIMINARY REPORT Progress Report, Dec. 1972 - May 1973
Monem Abdel-Gawad, Principal Investigator, Joel Silverstein, and Linda Tubbesing Jun. 1973 48 p refs ERTS
(Contract NAS5-21767)
(E73-10769; NASA-CR-133136) Avail: NTIS HC $4.50 CSCL 08K

The author has identified the following significant results. ERTS-1 imagery covering the eastern California-Nevada seismic belt were utilized to study the fault pattern in relation to the distribution of earthquake epicenters and Quaternary volcanic rocks. Many suspected faults not previously mapped were identified. These include several suspected shear zones in Nevada, faults showing evidence of recent breakage, and major lineaments. Highly seismic areas are generally characterized by Holocene faulting and Quaternary volcanic activity. However, several major fault segments showing evidence of recent breakage are associated with little or no seismicity. The tectonic pattern strongly suggests that the eastern California-Nevada seismic belt coincides with a major crustal rift associated with zones of lateral shear. New data on potentially active fault zones have direct practical applications in national and local earthquake hazard reduction programs. Positive contacts have been made with Kern and Ventura Counties to make results of this investigation available for application to their earthquake hazards definition projects.

N73-27246*# Oregon State Univ., Corvallis. Dept. of Soil Science.
MULTI-DISCIPLINE RESOURCE INVENTORY OF SOILS, VEGETATION AND GEOLOGY Progress Report, period ending 30 Jun. 1973
Gerald H. Simonson, Principal Investigator, D. P. Paine, R. D. Lawrence, J. A. Norgren, W. Y. Pyott, J. H. Herzog, R. J. Murray, and R. Rogers 17 Jul. 1973 25 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux falls, S. D. 57198 ERTS
(Contract NAS5-21831)
(E73-10770; NASA-CR-133137) Avail: NTIS HC $3.25 CSCL 08G

The author has identified the following significant results. Computer classification of natural vegetation, in the vicinity of Big Summit Prairie, Crook County, Oregon was carried out using MSS digital data. Impure training sets, representing eleven vegetation types plus water, were selected from within the area to be classified. Close correlations were visually observed between vegetation types mapped from the large scale photographs and the computer classification of the ERTS data (Frame 1021-18151, 13 August 1972).

N73-27247*# Vermont Univ., Burlington. Remote Sensing Lab.
SURVEY OF LAKE FLOODING FROM ERTS-1: LAKE CHAMPLAIN
Aulis O. Lind, Principal Investigator Jun. 1973 11 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57189 ERTS
(Contract NAS5-21753)
(E73-10771; NASA-CR-133138) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. ERTS-1 imagery showing seasonal lake-level conditions in Lake-Champlain can be used to assess shoreline change and flooding extent. MSS bands 6 and 7 provide maximum land-water contrasts and are the most useful for shoreline location. Shoreline changes observed between ERTS coverages of October 10 (low water) and April 7 and 25 (high water) are readily apparent and enlargement of specific scenes by a factor of four provides data which can be transferred to a map base. The unique synoptic view provided by ERTS-1 will make it possible to map shoreline positions occurring at a specific lake stage. Due to present government concerns over abnormally high lake levels, resource management questions have been raised regarding the extent, nature, and occurrence of inundation magnitude of shoreline change, and lake volume change.

N73-27248*# Cornell Univ., New York. Dept. of Natural Resources.
ERTS EVALUATION FOR LAND USE INVENTORY Progress Report, 13 Dec. 1972 - 13 Jun. 1973
Ernest E. Hardy, Principal Investigator 13 Jun. 1973 128 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21886)
(E73-10772; NASA-CR-133139) Avail: NTIS HC $8.50 CSCL 08F

The author has identified the following significant results. The feasibility of accomplishing a general inventory of any given region based on spectral categories from satellite data has been demonstrated in a pilot study for an area of 6300 square kilometers

in central New York State. This was accomplished by developing special processing techniques to improve and balance contrast and density for each spectral band of an image scene to compare with a standard range of density and contrast found to be acceptable for interpretation of the scene. Diazo film transparencies were made from enlarged black and white transparencies of each spectral band. Color composites were constructed from these diazo films in combinations of hue and spectral bands to enhance different spectral features in the scene. Interpretation and data takeoff was accomplished manually by translating interpreted areas onto an overlay to construct a spectral map. The minimum area interpreted was 25 hectares. The minimum area geographically referenced was one square kilometer. The interpretation and referencing of data from ERTS-1 was found to be about 88% accurate for eight primary spectral categories.

N73-27249*# Argus Exploration Co., Los Angeles, Calif.
EVIDENCE OF A MAJOR FAULT ZONE ALONG THE CALIFORNIA-NEVADA STATE LINE 35 DEG 30 MIN TO 36 DEG 30 MIN NORTH LATITUDE
Ira C. Bechtold, Principal Investigator, Mark A. Liggett, and John F. Childs Jul. 1973 13 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21809)
(E73-10773; NASA-CR-133140) Avail: NTIS HC $3.00 CSCL 08E

The author has identified the following significant results. Geologic reconnaissance guided by analysis of ERTS-1 and Apollo-9 satellite imagery and intermediate scale photography from X-15 and U-2 aircraft has confirmed the presence of a major fault zone along the California-Nevada state line, between 35 deg 30 min and 36 deg 30 min north latitude. The name Pahrump Fault Zone has been suggested for this feature after the valley in which it is best exposed. Field reconnaissance has indicated the existence of previously unreported faults cutting bedrock along range fronts, and displacing Tertiary and Quaternary basin sediments. Gravity data support the interpretation of regional structural discontinuity along this zone. Individual fault traces within the Pahrump Fault Zone form generally left-stepping en echelon patterns. These fault patterns, the apparent offset of a Laramide age thrust fault, and possible drag folding along a major fault break suggest a component of right lateral displacement. The trend and postulated movement of the Pahrump Fault Zone are similar to the adjacent Las Vegas Shear Zone and Death Valley-Furnace Creek Faults, which are parts of a regional strike slip system in the southern Basin-Range Province.

N73-27250*# Argus Exploration Co., Los Angeles, Calif.
A RECONNAISSANCE SPACE SENSING INVESTIGATION OF CRUSTAL STRUCTURE FOR A STRIP FROM THE EASTERN SIERRA NEVADA TO THE COLORADO PLATEAU Progress Report, 1 Jan. - 30 Jun. 1973
Ira C. Bechtold, Principal Investigator, Mark A. Liggett, and John F. Childs Jul. 1973 45 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21809)
(E73-10774; NASA-CR-133141) Avail: NTIS HC $4.25 CSCL 08E

The author has identified the following significant results. Research progress in applications of ERTS-1 MSS imagery to study of Basin-Range tectonics is summarized. Field reconnaissance of ERTS-1 image anomalies has resulted in recognition of previously unreported fault zones and regional structural control of volcanic and plutonic activity. Nimbus, Apollo 9, X-15, U-2, and SIAR imagery are discussed with specific applications, and methods of image enhancement and analysis employed in the research are summarized. Field areas studied and methods employed in geologic field work are outlined.

N73-27251*# Ohio Dept. of Economic and Community Development, Columbus.
RELEVANCE OF ERTS-1 TO THE STATE OF OHIO Semiannual Progress Report, Jan. - Jun. 1973
David C. Sweet, Terry L. Wells, and George E. Wukelic, Principal Investigators 16 Jul. 1973 50 p refs Prepared for Battelle Columbus Labs. Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contracts NAS5-21782; BCL-72-17/G-1793)
(E73-10775; NASA-CR-133142; SAPR-2) Avail: NTIS HC $4.50 CSCL 08F

The author has identified the following significant results. During the first six months of project effort the ability of ERTS-1 imagery to be used for mapping and inventorying strip-mined areas in southeastern Ohio was reported as a significant project result. During this reporting period, the potential of using ERTS-1 imagery in water quality and coastal zone management of Lake Eire became apparent and the extent that ERTS-1 imagery could contribute to localized (metropolitan/urban), multicounty, and overall state land use needs was experimentally demonstrated.

N73-27252*# Indiana Geological Survey, Bloomington.
APPLICATION OF ERTS-A IMAGERY TO FRACTURE RELATED MINE SAFETY HAZARDS IN THE COAL MINING INDUSTRY Progress Report, Jan. - Jul. 1973
Charles E. Wier, Frank J. Wobber, Principal Investigators (Earth Satellite Corp., Washington, D. C.), R. V. Amato (Earth Satellite Corp., Washington, D. C.), and O. R. Russell Jul. 1973 79 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21795)
(E73-10776; NASA-CR-133143) Avail: NTIS HC $6.00 CSCL 08I

The author has identified the following significant results. New fracture detail of Indiana has been observed and mapped from ERTS-1 imagery. Studies so far indicate a close relationship between the directions of fracture traces mapped from the imagery, fractures measured on bedrock outcrops, and fractures measured in the underground mines. A seasonal dependence of satellite fracture detection has been established based on vegetational tone differences and solar illumination angle. Numerous image enhancement techniques were tested for improved fracture detection and it was demonstrated that for glacial drift-covered areas of Indiana these techniques were of little value. Manual analysis procedures have, however, been successful. Previously unknown areas of mine subsidence have been observed and field checked. Subsidence-prone areas which are readily detectable on ERTS-1 imagery have been established. A prototype National Mined Lands inventory photomap was made to coincide with the Vincennes 1:250,000 map sheet and distributed to members of Congress and various governmental and mining industry officials. A fracture-lineament map and a mine hazards prediction map are being prepared to classify the test area by the relative potential of rooffall hazrads in future underground mining.

N73-27253*# Water Survey of Canada, Ottawa (Ontario).
DATA RETRANSMISSION FROM WATER SURVEY OF CANADA GAUGING STATIONS USING THE ERTS DATA COLLECTION SYSTEM
R. A. Halliday, Principal Investigator 9 Jul. 1973 7 p Presented at ERTS-1 Data Collection Workshop, Wallops Station, Va., 30-31 May 1973 Sponsored by NASA ERTS
(E73-10777; NASA-CR-133144) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant resutls in this report.

N73-27254*# Old Dominion Univ. Research Foundation, Norfolk, Va.
THE USE OF ERTS-1 TO MORE FULLY UTILIZE AND APPLY MARINE STATION DATA TO THE STUDY OF PRODUCTIVITY ALONG THE EASTERN SHELF EXPANDED WATERS OF THE UNITED STATES Bimonthly Report, 1 Apr. - 31 May 1973
Harold G. Marshall 31 May 1973 2 p ERTS
(Contract NAS5-21816)
(E73-10778; NASA-CR-133145) Avail: NTIS HC $3.00 CSCL 08A

There are no author-identified significant results in this report.

N73-27255*# Old Dominion Univ. Research Foundation, Norfolk, Va.
CORRELATION OF SATELLITE AND GROUND DATA IN AIR POLLUTION STUDIES Bimonthly Reports, 1 Feb. - 31 Mar. 1973 and 1 Apr. - 31 May 1973
G. E. Copeland, Principal Investigator, A. R. Bandy, R. N. Blais, and G. M. Hilton 31 May 1973 13 p ERTS
(Contract NAS5-21816)
(E73-10779; NASA-CR-133146) Avail: NTIS HC $3.00 CSCL 04A

There are no author-identified significant resutls in this report.

N73-27256*# National Oceanic and Atmospheric Administration, Miami, Fla.
REMOTE SENSING OF OCEAN CURRENTS Bimonthly Report, 4 May - 4 Jul. 1973
George A. Maul, Principal Investigator 4 Jul. 1973 24 p refs ERTS
(NASA Order S-70246-AG)
(E73-10780; NASA-CR-133147) Avail: NTIS HC $3.25 CSCL 08C

The author has identified the following significant results. Sea ice is detectable in all of the MSS bands and can be distinguished from clouds through a number of interpretive keys. Overall, MSS-4 and 5 appear to be better for mapping the ice edge, whereas MSS-7 provides greater detail in the ice features.

N73-27257*# California Earth Science Corp., Santa, Monica.
FAULT TECTONICS AND EARTHQUAKE HAZARDS IN THE PENINSULAR RANGES, SOUTHERN CALIFORNIA Monthly Progress Report
Paul M. Merifield, Principal Investigator 5 Jul. 1973 3 p EREP
(Contract NAS9-13260)
(E73-10781; NASA-CR-133148; MPR-1) Avail: NTIS HC $3.00 CSCL 08K

There are no author-identified significant results in this report.

N73-27258*# Earth Satellite Corp., Berkeley, Calif.
EVALUATION OF USEFULNESS OF SKYLAB EREP S-190 AND S-192 IMAGERY IN MULTISTAGE FOREST SURVEYS Monthly Progress Report, 1-30 Jun. 1973
Philip G. Langley, Principal Investigator 30 Jun. 1973 3 p EREP
(Contract NAS9-13289)
(E73-10782; NASA-CR-133149; MPR-4) Avail: NTIS HC $3.00 CSCL 02F

There are no author-identified significant results in this report.

N73-27259*# Environmental Research Inst. of Michigan, Ann Arbor.
STUDY OF RECREATIONAL LAND AND OPEN SPACE USING OF SKYLAB IMAGERY Monthly Report, 1-30 Jun. 1973
I. J. Sattinger 6 Jul. 1973 1 p EREP
(Contract NAS9-13283)
(E73-10783; NASA-CR-133150; MR-2) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-27260*# Iowa Univ., Iowa City.
EXPERIMENT TO EVALUATE FEASIBILITY OF UTILIZING SKYLAB-EREP REMOTE SENSING DATA FOR TECTONIC ANALYSIS OF THE BIGHORN MOUNTAINS REGION, WYOMING-MONTANA Quarterly Report, 1 Mar. - 30 Jun. 1973
Richard A. Hoppin, Principal Investigator 30 Jun. 1973 1 p EREP
(Contract NAS9-13313)
(E73-10784; NASA-CR-133151) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N73-27261*# National Marine Fisheries Service, Bay Saint Louis, Miss.
A SUMMARY OF SELECTED EARLY RESULTS FROM THE ERTS-1 MENHADEN EXPERIMENT
William H. Stevenson, Principal Investigator, Andrew J. Kemmerer, Joseph A. Benigno, Gladys B. Reese, and Frederick C. Minkler 29 Jun. 1973 37 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70246-AG)
(E73-10785; NASA-CR-133152) Avail: NTIS HC $4.00 CSCL 08A

The author has identified the following significant results. Imagery from ERTS-1 satellite was used in conjunction with aerial photographically-sensed menhaden distribution information, sea truth oceanographic measurements, and commercial fishing information from a 8685 square kilometer study area in the north-central portion of the Gulf of Mexico to demonstrate relationships between selected oceanographic parameters and menhaden distribution. ERTS-1 imagery and menhaden distribution, and ERTS-1 imagery and oceanographic parameters. ERTS-1, MSS band 5 imagery density levels correlated with photographically detected menhaden distribution patterns and could be explained based on sea truth Secchi disc transparency and water depth measurements. These two parameters, together with surface salinity, Forel-Ule color, and chlorophyll-a also were found to correlate significantly with menhaden distribution. Eight empirical models were developed which provided menhaden distribution predictions for the study area on combinations of Secchi disc transparency, water depth, surface salinity, and Forel-Ule color measurements.

N73-27262*# Geological Survey, Denver, Colo.
A STUDY OF MORPHOLOGY, PROVENANCE, AND MOVEMENT OF DESERT SAND SEAS IN AFRICA, ASIA, AND AUSTRALIA Progress Report, 1 Jan. - 30 Jun. 1973
Edwin D. McKee, Carol S. Breed, and Lawrence F. Harris, Principal Investigators 1 Jul. 1973 6 p refs ERTS
(NASA Order S-70243-AG-4)
(E73-10786; NASA-CR-133153) Avail: NTIS HC $3.00 CSCL 08M

The author has identified the following significant results. The assembling of photomosaics from color prints of ERTS images has made possible the recognition and description of sand patterns, and these are to be the basis of a worldwide classification of sand bodies. Progress has been as rapid as the acquisition of the bulk composite images will permit and for some areas the mosaics are now nearly complete. A second step, which consists of the accumulation and analysis of regional wind data, to be plotted as overlays for the dune patterns, is now underway and should soon give tangible results. Other aspects of the project include the gathering of ground truth in the form of air photographs, needed to interpret geomorphic forms and the sampling of sand deposits for analyzing the texture and composition of sand bodies. A start has been made on these studies in several selected areas.

N73-27263*# Geological Survey, Menlo Park, Calif.
IDENTIFICATION OF GEOSTRUCTURES OF CONTINENTAL CRUST, PARTICULARLY AS THEY RELATE TO MINERAL RESOURCE EVALUATION Progress Report, 1 Mar. - 31 May 1973
George Gryc, Principal Investigator and Ernest H. Lathram 15 Jun. 1973 7 p refs ERTS
(NASA Order S-70243-AG-1)
(E73-10787; NASA-CR-133154) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. The southeastward continuation of a fault that has been mapped in the vicinity of Dan Creek, Alaska, shows up as a lineament on ERTS-1 image 1043-20163 that can be traced for more than 50 miles southeastward to beyond the Alaska-Canada boundary. The lineament probably reflects a major fault that is significant in understanding the complicated tectonics of the Wrangell Mountains-Saint Elias Mountains complex. From a study of the ERTS-1 image, low level vertical photography, and limited field work in the largely unmapped region, E.M. Mackevett, Jr.,

speculates that the eastern part of the fault may mark the southern boundary of a mild-Paleozoic metamorphic terrane that constitutes the westernmost known extent of the Alexander terrane of Berg, Jones, and Richter (1972) and correlates with the Kaskawulsh Group in Canada. This terrane, which consists dominantly of marble, was recognized during 1972 reconnaissance mapping in the eastcentral part of the McCarthy quadrangle by MacKevett, D.L. Jones, and D.H. Richter and contrasts strongly with the dominantly volcanic and volcanoclastic terrane of Pennsylvanian and Permian age that forms the basement in most of the McCarthy quadrangle.

N73-27264*# Geological Survey, Menlo Park, Calif.
PRINCIPAL SOURCES AND DISPERSAL PATTERNS OF SUSPENDED PARTICULATE MATTER IN NEARSHORE SURFACE WATERS OF THE NORTHEAST PACIFIC OCEAN AND THE HAWAIIAN ISLANDS Progress Report, 1 Apr. - 31 May 1973
Paul R. Carlson, Principal Investigator 12 Jun. 1973 9 p ref ERTS
(NASA Order S-70243-AG-7)
(E73-10788; NASA-CR-133155) Avail: NTIS HC $3.00 CSCL 08J

The author has identified the following significant results. ERTS-1 green and red band imagery supplemented by U-2 photographs provides synoptic views of turbid, nearshore, near-surface bodies of water which adds to the body of knowledge about the coastal ocean necessary for a thorough understanding of the dynamic environment. Turbidity and suspended sediment measurements made in the Gulf of the Farallones correlate well with water tonal patterns visible on satellite imagery. Three successively seaward zones of turbid water could be delineated. Secchi disc visibility tests were the most definitive, ranging from < or = 2 meters in the main plume, to almost 3 meters in the second zone of turbid water, to 4 meters in the furthest seaward zone of turbid water measured. These variations in water clarity were reinforced by suspended sediment concentrations which ranged from 26-28 mg/1, to 20-24 mg/1, to 11-15 mg/1, respectively, in each of the three masses of water. Transmissometer readings were basically in agreement with the suspended sediment and Secchi disc values measured. Satellite imagery and U-2 photographs of the California coastal zone taken early in April 1973 show numerous plumes of suspended sediment being deflected southward. This indicates a southward flow of the nearshore, near-surface waters, a reversal from that noted in January 1973.

N73-27265*# Geological Survey, Washington, D.C.
IRON-ABSORPTION BAND ANALYSIS FOR THE DISCRIMINATION OF IRON-RICH ZONES Progress Report, 1 Mar. - 30 Apr. 1973
Lawrence C. Rowan, Principal Investigator 25 May 1973 4 p ERTS
(NASA Order S-70243-AG-4)
(E73-10789; NASA-CR-133156) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N73-27266*# Geological Survey, Tucson, Ariz.
DYNAMICS OF DISTRIBUTION AND DENSITY OF PHREATOPHYTES AND OTHER ARID-LAND PLANT COMMUNITIES Progress Report, 1 Mar. - 30 Apr. 1973
Raymond M. Turner, Principal Investigator 1 Jun. 1973 3 p ERTS
(NASA Order S-70243-AG-2)
(E73-10790; NASA-CR-133157) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-27267*# Bureau of Sport Fisheries and Wildlife, Washington, D.C.
AN EVALUATION OF SPACE ACQUIRED DATA AS A TOOL FOR WILDLIFE MANAGEMENT IN ALASKA Progress Report, 1 Jul. 1972 - 1 May 1973
Bill J. VanTries, Principal Investigator 1 May 1973 6 p ERTS
(NASA Order S-70243-AG)
(E73-10791; NASA-CR-133158) Avail: NTIS HC $3.00 CSCL 06C

The author has identified the following significant results. Interpretation of ERTS-1 imagery by color-coded densitometric displays and digital processes data verified that with adequate quadrat in situ sampling ERTS-1 data could be extrapolated to describe accurately the vegetative characteristics of analogous sites, and that surface acres of water for waterfowl production were obtainable for ponds a minimum of 5 acres in size.

N73-27268*# Bureau of Reclamation, Denver, Colo.
APPLICATION OF REMOTE SENSING TO SELECTED BUREAU OF RECLAMATION PROJECTS Progress Report, 1 Jan. - 2 Jul. 1973
Larry D. Cast, Principal Investigator 2 Jul. 1973 4 p refs ERTS
(NASA Order S-70243-AG)
(E73-10792; NASA-CR-133159) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-27269*# National Environmental Satellite Service, Washington, D.C.
EVALUATION OF ERTS DATA FOR CERTAIN OCEANOGRAPHIC USES Progress Report, May - Jun. 1973
Alan E. Strong, Principal Investigator [1973] 2 p ERTS
(NASA Order S-70246-AG)
(E73-10793; NASA-CR-133160) Avail: NTIS HC $3.00 CSCL 08C

The author has identified the following significant results. A significant result was reported 13 July on anomalous dark patches observed in certain ERTS-1 images. This sunglint related feature is possible whenever the solar elevation is greater than 55 deg and the surface waters are calm. It is observed in all MSS bands. Although the bright specular point is nearly 300 nm from nadir no bright specular returns are possible with a 0930 local time descending path-only diffuse glitter, that may reach reflectance levels of 1-2% under wind speeds of 5-10 m/sec and solar elevations greater than 60 deg.

N73-27270*# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
SEDIMENT PATTERN CORRELATION WITH INFLOW AND TIDAL ACTION Progress Report
Warren E. Grabau, Principal Investigator 17 Jul. 1973 1 p ERTS
(NASA Order S-70259-AG)
(E73-10794; NASA-CR-133161) Avail: NTIS HC $3.00 CSCL 08J

There are no author-identified significant results in this report.

N73-27271*# Delaware Univ., Newark.
DYNAMICS OF PLANKTON POPULATIONS IN UPWELLING AREAS
Karl-Heinz Szekielda, Principal Investigator Jul. 1973 61 p refs ERTS
(Contract NAS5-21784)
(E73-10795; NASA-CR-133187) Avail: NTIS HC $5.25 CSCL 08A

There are no author-identified significant results in this report.

N73-27272*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
[DETECTION AND MONITORING OIL POLLUTION FROM SKYLAB EREP SENSORS] Quarterly Progress Report, 7 Mar. - 31 May 1973
Robert Horvath, Principal Investigator 12 Jun. 1973 2 p EREP
(Contracts NAS9-13281; DOT-CG-24063-A)
(E73-10796; NASA-CR-133207; Rept-101800-4-L; QPR-1) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-27273*# Argus Exploration Co., Los Angeles, Calif.
[ACQUISITION OF WEATHER AND GROUND DATA FOR SKYLAB] Monthly Progress Report, 11-30 Apr. 1973
Ira C. Bechtold, Principal Investigator 30 Apr. 1973 2 p EREP
(Contract NAS9-13269)
(E73-10797; NASA-CR-133203) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-27274*# South Dakota State Univ., Brookings. Remote Sensing Inst.
STATE OF READINESS
Victor I. Myers, Principal Investigator 22 May 1973 3 p EREP
(Contract NAS9-13337)
(E73-10798; NASA-CR-133204) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-27275*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLICATION OF ERTS AND EREP IMAGES TO GEOLOGIC INVESTIGATIONS OF THE BASIN AND RANGE: COLORADO PLATEAU BOUNDARY IN NORTHWESTERN AND NORTH CENTRAL ARIZONA Progress Report, 15 Apr. - 15 Jun. 1973
A. F. H. Goetz, F. C. Billingsley, D. P. Elston (Geol. Surv., Flagstaff, Ariz.), I. Lucchitta (Geol. Surv., Flagstaff, Ariz.), and E. M. Shoemaker (Calif. Inst. of Tech., Pasadena) 23 Jul. 1973 9 p refs Sponsored by NASA ERTS
(E73-10799; NASA-CR-133205) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. Regional mapping using ERTS-1 images has led to the recognition of two parallel northeast-trending systems of normal faults, the Bright Angel and Mesa Butte fault systems, each of which can be traced at least 100 miles. Many eruptive centers appear to be localized along these fault systems or along their extensions. The faults are chiefly observed in Phanerozoic rocks and have minor displacement, but are interpreted to reflect fault zones of major displacement in the crystalline Precambrian basement. The location of epicenters of recent earthquakes and reports of earthquakes by residents in the region suggest that the Bright Angel and Mesa Butte fault systems are currently active.

N73-27276*# Research Triangle Inst., Durham, N.C.
[DEVELOPMENT OF MATHEMATICAL MODELS FOR PROCESSING ALTIMETER DATA] Monthly Progress Report, 1-31 May 1973
Lee S. Miller, Principal Investigator and Gary S. Brown 11 Jun. 1973 2 p EREP
(Contract NAS9-13304)
(E73-10801; NASA-CR-133208) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-27277*# Earth Satellite Corp., Washington, D.C.
APPLICATION OF EREP IMAGERY TO FRACTURE RELATED MINE SAFETY HAZARDS AND ENVIRONMENTAL PROBLEMS IN MINING Quarterly Progress Report
Charles E. Wier, Frank J. Wobber, Principal Investigators, Roger V. Amato, and Orville R. Russell 17 Jul. 1973 3 p Prepared for Ind. Geol. Surv. EREP
(Contract NAS9-13358)
(E73-10802; NASA-CR-133209; QPR-1) Avail: NTIS HC $3.00 CSCL 08I

There are no author-identified significant results in this report.

N73-27278*# Geological Survey, Miami, Fla.
ADVANTAGES OF ERTS DATA COLLECTION SYSTEM IN SOUTH FLORIDA Progress Report, 1 Apr. - 1 Jun. 1973
A. L. Higer, Principal Investigator, E. T. Wimberly, E. H. Cordes, and A. E. Coker 1 Jun. 1973 5 p ERTS
(NASA Order S-70243-AG-7)
(E73-10803; NASA-CR-133287) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-27279*# Bureau of Indian Affairs, Washington, D.C.
TIMBER RESOURCES INFORMATION SYSTEM Progress Report, 1 Jan. - 30 Jun. 1973
Arthur M. Woll, Principal Investigator 23 Jul. 1973 5 p ERTS
(NASA Order S-70243-AG-3)
(E73-10804; NASA-CR-133288) Avail: NTIS HC $3.00 CSCL 02F

The author has identified the following significant results. The investigators are convinced that high altitude photography when supported with ground measurements and existing surveys, contains all the resource data needed for overall land management planning. This overall planning would include land use classification, environmental impact statements, etc. First inspection of the ERTS-1 RBV imagery on the Quinault Reservation shows that much of the cultural and resource detail can be identified. Of particular note, is the obvious contrast between recently harvested timber cutting blocks as opposed to those cut more than a year ago. The RBV color composite would have been of better definition if band 3 had been excluded. Land managers are disappointed at first viewing ERTS-1 imagery in that it is not stereoscopic and find the scale and resolution at the 9 x 9 format difficult to interpret or translate to their ground truth. Arrangements are being made to have 1:250,000 enlargement prints made for their use.

N73-27280*# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
INVENTORY OF FOREST AND RANGELAND AND DETECTION OF FOREST STRESS Progress Report, 1 Jan. - 30 Jun. 1973
Robert C. Heller, Principal Investigator, Robert C. Aldrich, Frederick P. Weber, and Richard S. Driscoll 10 Jul. 1973 21 p ERTS
(NASA Order S-70251-AG)
(E73-10805; NASA-CR-133289) Avail: NTIS HC $3.25 CSCL 20F

The author has identified the following significant results. Visual interpretation of the range site on the bulk color composite of scene 1028-17135 permits: (1) identification of six different grassland communities; (2) separation of grasslands from scrub communities and forest land; (3) identification of ponderosa pine from aspen but not to separate spruce-fir, Douglas-fir, and lodgepole pine from each other; (4) identification of surface dredging and new urban development in flat grasslands but not to identify new urban development in forested areas; (5) determination that the three scrub communities of willow, mountain mahogany, and oakbrush can not be separated from each other. Kudzu vine is a serious threat to forest management in Southeastern United States and can be detected on ERTS-1 multispectral data from early October to mid-November. At other dates, earlier or later, it is confused with other crops. All three forest sites have suffered from excessive cloudiness and snow cover. One good image of the island of Hawaii was received and the dying of native ohia trees between Mauna Loa and Mauna Kea volcanoes shows up as a dark area on the combined 70 mm image.

N73-27281*# Vermont Univ., Burlington. Remote Sensing Lab.
ICE DEVELOPMENT ON LAKE CHAMPLAIN
A. O. Lind, Principal Investigator Jul. 1973 5 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21753)
(E73-10806; NASA-CR-133290) Avail: NTIS HC $3.00 CSCL 08L

The author has identified the following significant results. Only one usable ERTS-1 scene was available for lake ice survey of Lake Champlain. The January 8, 1973, coverage (image no. 1169-11521) revealed the presence of various ice tones, patterns, and arrangements as well as open water. MSS band

5 imagery provided the most useful data. While it was not possible to differentiate open water from one - two day old ice, which only occurred over a small portion of the lake area, it was possible to interpret the tonal signatures of the frozen portion in terms of freezing history or age. The dark gray-tones of new, smooth ice contrasts with the medium gray-tones of older ice, and the rough texture of wind-jammed bay ice. Mapping of these patterns seems quite feasible with moderate enlargement of the scene (2 to 3X).

N73-27282*# Nebraska Univ., Lincoln. Dept. of Agronomy.
EVALUATION OF ERTS-1 IMAGERY IN MAPPING AND MANAGING SOIL AND RANGE RESOURCES IN THE SAND HILLS REGION OF NEBRASKA Progress Report, 1 Jan. - 30 Jun. 1973
Paul M. Seevers and James V. Drew, Principal Investigators Jul. 1973 14 p ERTS
(Contract NAS5-21756)
(E73-10807; NASA-CR-133291) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. Collection of ground truth data provided ground cover percent and the components of ground cover makeup. Percent bare soil appears to have greatest influence on imagery density of sites studied. Forage density estimates can be made on band 5 of MSS, provided site category identification is known. Additional data are provided concerning forage density and vegetation-soil relationship by color composites of MSS imagery. Reflectance differences shown on MSS bands 6 and 7 by Sand Hills lakes are related to water quality and possibly more specifically to total dissolved ions present in the water. Winter imagery with snow cover and low sun angle shows a marked enhancement of topography are associated with differences in forage density. High altitude color infrared photography appears to be a usable tool for recognition, measurement, and evaluation of go-back land.

N73-27283*# Stanford Univ., Calif. School of Earth Sciences.
MULTISPECTRAL SIGNATURES IN RELATION TO GROUND CONTROL SIGNATURES USING NESTED SAMPLING APPROACH Progress Report, 2 May - 2 Jul. 1973
R. J. P. Lyon and A. A. Green, Principal Investigators 3 Jul. 1973 20 p ERTS
(Contract NAS5-21884)
(E73-10808; NASA-CR-133292; PR-4) Avail: NTIS HC $3.00 CSCL 05B

The author has identified the following signficant results. An experiment was conducted to evaluate the feasibility of using ERTS-1 MSS imagery for spot transmission measurements on selected sites. Using the 15-unit gray scale on the 70 mm positive imagery as the base of comparison, a correlation was made between the transmittance measured at each site on the imagery and the radiance values (counts) recorded on CCT tape by the spacecraft over the same sites. The imagery was enlarged by a 750-watt projector and focused on a white cardboard screen 6 meters from the screen. Observations were made on 30 sub-sites which were pre-selected for their differing image brightness and total area; all are dried pond beds. Observations were also made on average gray backgrounds and a small lake. There was a very good correlation between the density values obtained from projected imagery and radiance values received by the detector on the spacecraft. A shorter experiment time and closer integration of gray scale and site readings would avoid the variation in lamp intensities that occurred.

N73-27284*# Stanford Univ., Calif. School of Earth Sciences.
MULTISPECTRAL SIGNATURES IN RELATION TO GROUND CONTROL SIGNATURES USING NESTED SAMPLING APPROACH Progress Report, 3 Jan. - 2 Mar. 1973
R. J. P. Lyon and A. A. Green, Principal Investigators 3 Mar. 1973 9 p ERTS
(Contract NAS5-21884)
(E73-10809; NASA-CR-133293; PR-2) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-27285*# Stanford Univ., Calif. School of Earth Sciences.
MULTISPECTRAL SIGNATURES IN RELATION TO GROUND CONTROL SIGNATURES USING NESTED SAMPLING APPROACH Progress Report, 3 Nov. 1972 - 2 Jan. 1973
R. J. P. Lyon and A. A. Green, Principal Investigators 3 Jan. 1973 5 p ERTS
(Contract NAS5-21884)
(E73-10810; NASA-CR-133294; PR-1) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-27286*# Research Triangle Inst., Durham, N.C.
[COORDINATION OF GROUND TRUTH AND BASIC ALTIMETER DATA PROCESSING REQUIREMENTS] Monthly Progress Report, 1-30 Apr. 1973
Lee S. Miller and Gary S. Brown, Principal Investigators 11 May 1973 4 p EREP
(Contract NAS9-13304)
(E73-10811; NASA-CR-133295) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified signifcant results in this report.

N73-27287*# Research Triangle Inst., Durham, N.C.
[DEVELOPMENT OF MATHEMATICAL MODELS FOR PROCESSING S-193 RADAR ALTIMETER DATA] Monthly Progress Report, 1-3 Jun. 1973
Lee S. Miller and Gary S. Brown, Principal Investigators 11 Jul. 1973 2 p EREP
(Contract NAS9-13304)
(E73-10812; NASA-CR-133296) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-27288*# Nevada Univ., Reno.
USE OF SATELLITE IMAGERY FOR WILDLAND RESOURCE EVALUATION IN THE GREAT BASIN Progress Report
Paul T. Tueller, Principal Investigator Jul. 1973 17 p ERTS
(Contract NAS5-21870)
(E73-10813; NASA-CR-133297) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. Most major vegetation types of Nevada have been mapped with success. The completed set of mosaic overlays will be more accurate and detailed than previous maps compiled by various State and Federal agencies due to the excellent vantage point that ERTS-1 data affords. This new vegetation type map will greatly aid resource agencies in their daily work. Such information as suitable grazing areas, wildlife habitat, forage production, and approximate wildland production potentials can be inferred from such a map. There has been some success in detecting vegetational changes with the use of ERTS-1 MSS imagery, but exposure differences have somewhat confounded the results. Future plans include work to solve this problem.

N73-27289*# Colorado School of Mines, Golden. Dept. of Geology.
GEOLOGIC AND MINERAL AND WATER RESOURCES INVESTIGATIONS IN WESTERN COLORADO USING ERTS-1 DATA Progress Report, 31 Jun. - 11 Nov. 1972
Daniel H. Knepper, Principal Investigator Dec. 1972 49 p ERTS
(Contract NAS5-21778)
(E73-10814; NASA-CR-132754) Avail: NTIS HC $4.50 CSCL 08G

The author has identified the following significant results. Preliminary geologic interpretations of selected ERTS-1 scenes in central and western Colorado indicate that lithologic discrimination and structural interpretation can be made on ERTS-1 images. Generally, lithologic units mapped on ERTS-1 images are composed of 2 or more recognized geologic formations and should more correctly be referred to as remote sensing units. Faults mapped on ERTS-1 images in western Colorado correspond well with faults mapped on the geologic map of Colorado (1:500, 000). Stratigraphic offset was easily detected along faults as short as 3 km: it is anticipated that faults as short as 1/2-1 km

should be identifiable. Several previously unmapped major linear features, possibly faults, were detected and mapped on ERTS-1 imagery. Stereoscopic analysis of ERTS-1 imagery greatly enhances the capability of the interpreter. Structural features and lithologic contacts are more accurately traced and more remote sensing units (lithologic) can be defined. Ambiguous or questionable structural interpretations are commonly quickly resolved by stereoscopic analysis.

N73-27290*# Kansas Univ., Lawrence. Space Technology Center.
[SOIL MOISTURE ANALYSIS] Monthly Progress Report
Joe R. Eagleman, Principal Investigator 20 Jul. 1973 1 p EREP
(Contract NAS9-13273)
(E73-10815; NASA-CR-133309) Avail: NTIS HC $3.00 CSCL 08M

There are no author-identified significant results in this report.

N73-27291*# Oregon State Univ., Corvallis.
COMPARATIVE EVALUATION OF SPATIAL FEATURES IN AUTOMATIC LAND USE CLASSIFICATION FROM PHOTOGRAPHIC IMAGERY
James H. Herzog and Roy C. Rathja 17 Jul. 1973 9 p refs Proposed for presentation at Conf. on Machine Processing of Remotely Sensed Data, Lafayette, Ind., 16-18 Oct. 1973 ERTS
(Contract NAS5-21831)
(E73-10816; NASA-CR-133310) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-27292*# Hunting Surveys, Ltd., Boreham Wood (England).
STUDY OF TECHNIQUES AND APPLICATIONS OF SATELLITE IMAGERY TO SMALL SCALE MAPPING Progress Report, Jul. 1972 - Jul. 1973
P. G. Mott, Principal Investigator Jul. 1973 7 p Sponsored by NASA ERTS
(E73-10817; NASA-CR-133311) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-27293*# Texas Univ., Austin. Dept. of Geological Sciences.
STREAM NETWORK ANALYSIS FROM ORBITAL AND SUB-ORBITAL IMAGERY Quarterly Progress Report
Victor R. Baker, Principal Investigator 24 Jul. 1973 4 p EREP
(Contract NAS9-13312)
(E73-10818; NASA-CR-133312) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-27294*# Long Island Univ., Greenvale, N.Y. Science Engineering Research Group.
AN INTERDISCIPLINARY STUDY OF THE ESTUARINE AND COASTAL OCEANOGRAPHY OF BLOCK ISLAND SOUND AND ADJACENT NEW YORK COASTAL WATERS Interim Report, Jan. - Jun. 1973
Edward F. Yost, Principal Investigator Jun. 1973 24 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21792)
(E73-10819; NASA-CR-133313; TR-20-2) Avail: NTIS HC $3.25 CSCL 08C

The author has identified the following significant results. ERTS-1 imagery of New York coastal waters has been photographically enhanced to emphasize apparent water color differences. Water samples have been collected simultaneously with the acquisition of satellite data. Water turbidity, particularly that arising from sewage dump areas, and sediment discharge from coastal inlets correlate well with the ERTS-1 color signatures.

N73-27295*# Geological Survey, Tacoma, Wash.
A LAKE AND SEA ICE EXPERIMENT WITH SKYLAB MICROWAVE RADIOMETRY Progress Report
W. J. Campbell, Principal Investigator 27 Jul. 1973 1 p Sponsored by NASA EREP
(E73-10820; NASA-CR-133314) Avail: NTIS HC $3.00 CSCL 08L

There are no author-identified significant results in this report.

N73-27296*# Minnesota State Planning Agency, St. Paul.
APPLICATION OF ERTS-1 IMAGERY TO STATE WIDE LAND INFORMATION SYSTEM IN MINNESOTA Progress Report, Jan. - Jun. 1973
Joseph E. Sizer, Principal Investigator 20 Jul. 1973 48 p ERTS
(Contract NAS5-21801)
(E73-10821; NASA-CR-133315) Avail: NTIS HC $4.50 CSCL 08B

There are no author-identified significant results in this report.

N73-27297*# Ecole Practique des Hautes Etudes, Paris (France). Lab. de Geomorphologie.
TELEDETECTION OF LITTORAL FRALIT PROGRAM ERTS-1 [LA TELEDETECTION DU LITTORAL PROGRAMME FRALIT ERTS 1]
Fernand Verger, Principal Investigator and Pierre DeMathieu 1973 24 p refs In FRENCH Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E73-10822; NASA-CR-133323) Avail: NTIS HC $3.25 CSCL 08A

There are no author-identified significant results in this report.

N73-27298*# Earth Satellite Corp., Washington, D.C.
SAMPLING STRATEGIES IN LAND USE MAPPING USING SKYLAB DATA Monthly Progress Report, Jun. 1973
David S. Simonett, Principal Investigator Jun. 1973 13 p refs EREP
(Contract NAS9-13314)
(E73-10823; NASA-CR-133324) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-27299*# International Business Machines Corp., Gaithersburg, Md.
ALL-DIGITAL PRECISION PROCESSING OF ERTS IMAGES Interim Report, Aug. 1972 - Jun. 1973
Ralph Bernstein, Principal Investigator Jul. 1973 44 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21716)
(E73-10827; NASA-CR-133332) Avail: NTIS HC $4.25 CSCL 05B

The author has identified the following significant results. ERTS-1 MSS and RBV data recorded on computer compatible tapes have been analyzed and processed, and preliminary results have been obtained. No degradation of intensity (radiance) information occurred in implementing the geometric correction. The quality and resolution of the digitally processed images are very good, due primarily to the fact that the number of film generations and conversions is reduced to a minimum. Processing times of digitally processed images are about equivalent to the NDPF electro-optical processor. The next phase of the effort involves the completion of geometric and radiometric analyses, the production and evaluation of annotated MSS and RBV images, error and configuration analyses, and further studies of the utility of the SSDA algorithm and of filtering techniques.

N73-27300*# New Mexico State Bureau of Mines and Mineral Resources, Socorro.
GEOLOGIC ANALYSIS AND EVALUATION OF ERTS-A IMAGERY FOR THE STATE OF NEW MEXICO Progress

Report, 15 May - 14 Jul. 1973
Frank E. Kottlowski, Principal Investigator and Karl VonderLinden 14 Jul. 1973 1 p ERTS
(Contract NAS5-21861)
(E73-10830; NASA-CR-133335) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N73-27301*# South Carolina State Development Board, Columbia.
APPLICATION OF MULTISPECTRAL PHOTOGRAPHY TO MINERAL AND LAND RESOURCES OF SOUTH CAROLINA Quarterly Progress Report
Norman K. Olson, Principal Investigator 19 Jul. 1973 1 p EREP
(Contract NAS8-29617)
(E73-10831; NASA-CR-133336; QPR-1) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N73-27302*# Texas Technological Univ., Lubbock. Remote Sensing Lab.
DYNAMICS OF PLAYA LAKES IN THE TEXAS HIGH PLAINS Progress Report, 1 Jun. - 31 Jul. 1973
C. C. Reeves, Jr., Principal Investigator 31 Jul. 1973 5 p ERTS
(Contract NAS5-21720)
(E73-10832; NASA-CR-133337) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-27303*# Environmental Research and Technology, Inc., Lexington, Mass.
USE OF ERTS DATA FOR MAPPING SNOW COVER IN THE WESTERN UNITED STATES Progress Report, 1 Jan. - 30 Jun. 1973
James C. Barnes, Principal Investigator, Clinton J. Bowley, and David A. Simmes Jul. 1973 34 p ERTS
(Contract NAS5-21803)
(E73-10833; NASA-CR-133338) Avail: NTIS HC $3.75 CSCL 08L

The author has identified the following significant results. Data have been analyzed primarily for two test sites, the central Arizona mountains and the southern Sierra Nevada in California. The results of the data analysis completed indicate that snow extent can be mapped from ERTS-1 imagery in more detail than is depicted on aerial survey snow charts. For the areas tested, the agreement between the percentage snow cover as determined from ERTS-1 data and from aerial survey snow charts is of the order of 5% for most cases. Moreover, it appears that although small details in the snowline can be mapped better from higher resolution aircraft photographs, boundaries of the areas of significant snow cover can be mapped as accurately from the ERTS-1 imagery as from the aircraft photography.

N73-27304*# Agricultural Research Service, Big Spring, Tex.
WIND EROSION OF SOILS Progress Report, 17 Mar. - 17 Jul. 1973
Donald W. Fryrear, Principal Investigator 31 Jul. 1973 3 p ERTS
(NASA Order S-70251-AG)
(E73-10834; NASA-CR-133339) Avail: NTIS HC $3.00 CSCL 08M

There are no author-identified significant results in this report.

N73-27305*# Wisconsin Univ., Milwaukee. Air Pollution Analysis Lab.
THE USE OF ERTS-1 SATELLITE DATA IN GREAT LAKES MESOMETEOROLOGICAL STUDIES Progress Report
Walter A. Lyons, Principal Investigator 30 Apr. 1973 35 p refs ERTS
(Contract NAS5-21736)
(E73-10835; NASA-CR-133340) Avail: NTIS HC $3.75 CSCL 04B

The author has identified the following significant results. A remarkable view of particulate air pollution was discovered in the vicinity of Buffalo, New York, on 20 June 1973. There was a classic all-shore lake breeze in progress, and it was obvious that dense smoke was present to the west of Buffalo over Lake Erie. This smoke was the pollution that had been produced by sources in the area which had been undercut by the inland rushing lake breeze front and which was then being advected lakewards in the return flow layer aloft. It is precisely this phenomena, the recirculation of pollutants in the lake breeze, that is the object of the full-scale EPA support field project being directed by the University of Wisconsin-Milwaukee in the summer of 1973.

N73-27306*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HOT AND COLD ATMOSPHERES FOR VANDENBERG AFB, CALIFORNIA (1973 VERSION)
D. L. Johnson 26 Jun. 1973 50 p refs
(NASA-TM-X-64756) Avail: NTIS HC $4.50 CSCL 04A

Extreme atmospheres, pertaining to summer (hot) and winter (cold) conditions for Vandenberg Air Force Base, California, are presented from 0- to 90-km altitudes. Computed values of pressure, e, kinetic temperature, virtual temperature, density, and relative differences (percentages from Vandenberg Reference Atmosphere, 1971 (VRA 71)) of the atmospheric parameters versus altitude are tabulated in increments of 250 m. Hydrostatic and gas law equations were used in conjunction with radiosonde and rocketsonde thermodynamic data in determining the vertical structure of the two atmospheric models. The summer-type density profile deviated from -9.0 percent (of the VRA-71) at the ground to 28.4 percent at 74.5-km altitude. The winter density profile went from 5.2 percent at the surface to -31.4 percent at 72 km. Author

N73-27307# Danish Meteorological Inst., Copenhagen.
UNMANNED GEOPHYSICAL OBSERVATORY AT NORD IN NORTH GREENLAND
Leif Kristensen (Danish Atomic Energy Comm., Risoe) and Jorgen Taagholt 1973 82 p refs
(ISBN-87-7478-073-5) Avail: NTIS HC $6.25

In the summer of 1972 a simple automatic climatological recording system, UGO-NORD, was installed at the Danish airport Nord in the eastern part of North Greenland (81 36 N, 16 40 W, WMO index number 04310). The equipment, its installation, and the future plans for its maintenance are described. Some preliminary results from the first month's measurements are reported. Author

N73-27308# Ionospharen-Institut Breisach (West Germany).
IONOSPHERE DATA, VERTICAL-ECHO-SOUNDING: FREIBURG, URSI-CODE 31, MARCH 1973 IONOSPHAER-EN-DATEN, VERTIKAL-ECHO-LOTUNG: FREIBURG, URSI-CODE 31, MAERZ 1973]
Mar. 1973 44 p refs In GERMAN and ENGLISH
(Rept-321F) Avail: NTIS HC $4.25

Daily summaries are presented for vertical echo sounding of the upper atmosphere over Freiburg, Germany during March, 1973. The data include charts of median values for the E and F regions, MUF(3000)F2, M(3000)F2, h'F2, hpF2, foFl, MUF (3000)F2l; M(3000)Fl, h'F, foE, foE2, h'E, foEs, fbEs, h'Es, Type Es, foT, and fmin. Author

N73-27309# Danish Meteorological Inst., Charlottenlund.
DIAGNOSTICS OF THE MAGNETOSPHERE BY MEANS OF NATURALLY OCCURRING ELF AND VLF WAVES
T. Stockflet Joergensen 1973 32 p refs Presented at Symp. on Plasma Waves, Instabilities and Interactions, Nord-Torpa, Norway, 6-12 Apr. 1972
(R-34; ISBN-87-7478-078-6) Avail: NTIS HC $3.75

Diagnostic methods for the magnetosphere based on observations from the ground and in space of naturally occurring waves in the frequency range from hundreds of Hz to several kHz are described. The most commonly occurring wave phenomena are defined, and theories of propagation and wave generation are presented. Methods of diagnostics for electron density, concentration of positive ions, emission source regions, and electric fields are also considered. Author

N73-27310# Danish Meteorological Inst., Charlottenlund.
ORIENTATION OF AURORAL ARCS AND PRECIPITATION PATTERN OF AURORAL PARTICLES
Knud Lassen 1973 26 p refs
(R-33; ISBN-87-7478-058-1) Avail: NTIS HC $3.50

Mass plots of the positions of quiet auroral arcs in corrected geomagnetic latitude-time polar graphs show that the arcs are ordered in a pattern of partly overlapping groups. Form and position analysis of the groups as a function of K sub p, as well as comparison with earlier published frequency maps lead to a precipitation pattern valid for incident particles which produce visual auroras. The pattern is composed of a precipitation area which follows the auroral zone from dusk to dawn, an evening and a morning spiral, high-latitude auroras in late afternoon and early evening, high-latitude (daytime cusp) auroras in late morning, and sun-oriented arcs across the polar cap, especially on the morning side of the pole. Author

N73-27311*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
O(D-1) PRODUCTION IN OZONE PHOTOLYSIS NEAR 310 nm
C.-L. Lin and W. B. DeMore 15 Jul. 1973 11 p refs
(Contract NAS7-100)
(NASA-CR-122206; JPL-TM-33-635) Avail: NTIS HC $3.00 CSCL 04A

Relative quantum yields of O(D-1)production, phi, in ozone photolysis from 275 nm to 334 nm were determined in the gas phase at 233 K. The O(D-1) was monitored by means of its reaction with isobutane to form isobutyl alcohol. The light source was a high pressure mercury lamp combined with a monochromator, with a bandwidth of 1.6 nm. The results show a constant phi below 300 nm, which is taken as unity on the basis of previous work. There is a very sharp fall-off in phi which is centered at 308 nm. At 313 nm phi is not greater than 0.1. Author

N73-27312*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MARS: MARINER 9 SPECTROSCOPIC EVIDENCE FOR H2O ICE CLOUDS
Robert J. Curran, Barney J. Conrath, Rudolf A. Hanel, Virgil G. Kunde, and John C. Rearl Jun. 1973 14 p refs Submitted for publication
(NASA-TM-X-66289; X-651-73-156) Avail: NTIS HC $3.00 CSCL 04A

Spectral features observed with the Mariner 9 Interferometer Spectrometer are identified as those of water ice. Measured spectra are compared with theoretical calulations for the transfer of radiation through clouds of ice particles with variations in size distribution and integrated cloud mass. Comparisons with an observed spectrum from the Tharsis Ridge region indicate water ice clouds composed of particles with mean radius 2.0 microns and integrated cloud mass 0.00005 g/sq cm. Author

N73-27313*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ION COMPOSITION DURING THE FORMATION OF A MIDLATITUDE E SUB S LAYER
A. C. Aikin, R. A. Goldberg, and A. Azcarraga (Inst. Nacional de Tecnica, Torrejon de Ardoz, Spain) Jun. 1973 14 p refs Submitted for publication
(NASA-TM-X-66276; X-625-73-166) Avail: NTIS HC $3.00 CSCL 04A

The positive ion composition within a midlatitude sporadic E layer has been measured with the aid of a rocket-borne ion mass spectrometer launched from El Arenosillo, Spain on July 3, 1972 at 0743 LMT. Ionograms taken before and during the rocket flight showed a developing sporadic E layer near 114 km. Rocket data showed peaks in electron density and metallic ions at this same height. Both the maximum and total content of the metals are observed to be greater on the downleg than the upleg measurement. Author

N73-27314*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE NIMBUS 4 INFRARED SPECTROSCOPY EXPERIMENT. 2: COMPARISON OF OBSERVED AND THEORETICAL RADIANCE FROM 425-1450 cm(MINUS 1)
V. G. Kunde, B. J. Conrath, R. A. Hanel, W. C. Maguire, C. Prabhakara, and V. V. Salomonson Jun. 1973 36 p refs Sponsored by NASA
(NASA-TM-X-66275; X-622-73-160) Avail: NTIS HC $4.00 CSCL 04A

The Nimbus 4 infrared interferometer spectrometer (IRIS) measured the thermal emission of the earth's atmosphere and surface from 400-1600/cm with an apodized spectral resolution of 2.8/cm. A comparison of theoretical radiances, computed from in-situ measurements and using a direct integration slant path atmospheric transmittance model, with the observed IRIS radiances has been made to verify the radiometeric and spectral performance of the instrument and to assess the accuracy of the atmospheric transmittances. The radiance comparison has indicated a relatively constant difference of less than 5% in the water vapor continuum in the 425-550/cm and 750-1200/cm atmospheric window regions while in the 667/cm CO2 band the difference was 5-10%. The absolute accuracy was found to be approximately 5-10% for each of the parameters; measured radiances, in-situ measurements, and the atmospheric transmittances, thus it is not possible to uniquely specify the degree of error arising from each parameter in the total resultant difference. Author

N73-27315*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NIMBUS 4 IRIS SPECTRA IN THE 750-1250/cm ATMOSPHERIC WINDOW REGION
V. G. Kunde, B. J. Conrath, R. A. Hanel, and C. Prabhakara May 1973 15 p refs Submitted for Publication
(NASA-TM-X-66281; X-622-73-191) Avail: NTIS HC $3.00 CSCL 04A

Several Nimbus 4 IRIS spectra are presented for the 700-1300/cm region as examples of free atmosphere spectra to illustrate problems encountered in interpreting window measurements. Several atmospheric windows near 936 and 960/cm appear significantly more transparent than the 899/cm window presently used in operational remote sensing systems. Author

N73-27316*# National Aeronautics and Space Administration, Washington, D.C.
THE SIGNIFICANCE OF BIOLOGICAL FACTORS IN THE WEATHERING OF ROCKS AND MINERALS
P. V. Ivashou Jul. 1973 29 p refs Transl. into ENGLISH from the publ. "Znacheniye Biologicheskikh Faktorov v Vyvetrivanii Porod i Mineralov" Moscow, Nauka, 1971 p 30-50
(NASA-TT-F-14892) Avail: NTIS HC $3.50 CSCL 08G

Biological influences of weathering are discussed. Topics discussed include: (1) confinement of plant associations to certain complexes of rocks and minerals, (2) effect of enzymes excreted by the root hairs of plants on mineral substrates, (4) effect of CO2 excreted by the roots of plants on the mineral substrate, (5) effect of microorganisms, and (6) the effects of animal activity. F.O.S.

N73-27317*# Techtran Corp., Glen Burnie, Md.
RESULTS OF REMOTE SOUNDING OF THE ATMOSPHERE AND OCEAN IN THE INFRARED AND MICROWAVE REGIONS ON THE 13TH VOYAGE OF THE SCIENTIFIC RESEARCH VESSEL "ACADEMICIAN KURCHATOV"
A. K. Gorodetskiy, D. T Matveyev, and A. P. Orlov Washington NASA Jul. 1973 22 p refs Transl. into ENGLISH of "Rezultaty Distantsionnogo Zondirovaniya Atmosfery i Okeana v Infrakrasnom i Mikrovolnovom Diapazonakh v XIII Reyse Nis "Akademik Kurchatov", Acad. of Sci., Inst. of Space Res., Moscow, report presented at Meeting of the Sov.-Am. Working Group on Remote Sensing of Natural Environment from Space, 12-17 Feb. 1973 47 p
(Contract NASw-2485)
(NASA-TT-F-14972) Avail: NTIS HC $3.25 CSCL 04A

Thermal emission from the sea surface and atmosphere were studied in the infrared and microwave regions by semiautomatic cameras and photometer aboard ship in the North Atlantic. The role of sea foam in affecting microwave emission was also examined. Author

N73-27318*# Techtran Corp., Glen Burnie, Md.
SPACE METHODS IN GEOGRAPHY
B. V. Vinogradov Washington NASA Jul. 1973 18 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Geogr. (Moscow), no. 3, 1972 p 79-89
(Contract NASw-2485)
(NASA-TT-F-14973) Avail: NTIS HC $3.00 CSCL 08F

Remote environment monitoring methods and equipment are discussed. Emphasis is placed on space techniques. Combined interpretation of space images of the earth is described. Cartography of natural formation, investigation of the dynamics and rhythm of the geosphere, and space geo-information systems are discussed. Author

N73-27319*# Linguistic Systems, Inc., Cambridge, Mass.
ESTIMATION OF THE ATMOSPHERIC EFFECTS IN THE PROBLEM OF COSMIC STUDY OF THE NATURAL RESOURCES OF THE EARTH BY EMISSION MEASUREMENTS FROM KOSMOS SATELLITES
M. S. Malkevich and A. S. Gurvich Washington NASA Jul. 1973 29 p refs Transl. into ENGLISH of "Otsenka Roli Atmosfery v Zadache Izucheniya Prirodnykh Resursov Zemli iz Kosmosa po Izmereniyam Isluchen iya so Sputnikov", Acad. of Sci. USSR, Inst. of Space Res., Moscow, report presented to the Meeting of the Sov.-Am. Working Group on Remote Sensing of the Natural Environment from Space, 12-17 Feb. 1973 32 p
(Contract NASw-2482)
(NASA-TT-F-14977) Avail: NTIS HC $3.50 CSCL 03B

Atmospheric noise was estimated from the measurements of: (1) the reflected sun radiation in visible and near infrared radiation, (2) the terrestrial emission in middle infrared and microwave regions fulfilled at the satellites Cosmos-149, Cosmos-243, Cosmos-320, and Cosmos-394 for the following problems: determination of the surface temperature, the spectral contrast of the reflectance of surfaces. The study of the water vapor and liquid water content in the atmosphere and within the cloud is suggested. It is illustrated by the examples of the measurements from the above mentioned satellites. The results of complex measurements to the earth emission in visible, infrared, and microwave regions are used for discrimination of the liquid and ice clouds. The application of statistical methods for an optimal account of the atmospheric effects and for recognition of natural objects in treated. Author

N73-27320*# Linguistic Systems, Inc., Cambridge, Mass.
SEVERAL PROPERTIES OF THE RADIOEMISSION OF LAND SURFACES
A. S. Gurvich Washington NASA Jul. 1973 30 p refs Transl. into ENGLISH of "Nekotoryye Osobennosti Radioizlucheniya Zemnykh Pokrovov", Acad. of Sci. USSR, Inst. of Space Res., Moscow, report presented at Meeting of the Sov.-Am. Working Group on Remote Sensing of Natural Environment from Space, 12-17 Feb. 1973 31 p
(Contract NASw-2482)
(NASA-TT-F-14978) Avail: NTIS HC $3.50 CSCL 08M

An analysis was made of the results of radio-brightness field measurements made by Cosmos 243 over the civilized landscape (the European part of the U.S.S.R.) and over the area of solid ice (the Antarctic regions). The data of cosmic measurements of the radio-brightness with temperature and soil humidity over the civilized area are compared with the data of the surface meteorological stations. It was shown that at the wave of 0.8 cm the radiobrightness depends mostly upon the temperature of the surface layer of the soil. The influence of the soil humidity starts noticeable upon the radiobrightness at the wave of 8.5 cm. This influence still increases if one considers the ratio of the radiobrightness at two wave lengths. It is noted that spectral measurements in microwave regions with large wave length range can give the information about temperature and soil humidity. Measurements of the radiobrightness of the Antarctic's ice gave a value much lower that computed. Author

N73-27321# Florida Univ., Gainesville.
REMOTE SENSING OF WATER QUALITY: A STATE OF THE ART REPORT
William J. Mitsch May 1973 15 p refs Supported in part by the Dept. of Interior
(Publ-21) Avail: NTIS HC $3.00

Remote sensing, or the carrying out of aerial or space surveys of the earth's surface, is finding several applications in the fields of water quality and water resource management. It offers a means of obtaining large amounts of data, but its value is in the expansion of data in the spatial, temporal and spectral modes. The most valuable techniques presently are photography, infrared scanning and multispectral scanning. Aircraft applications include the measuring of the distribution of various waste discharges into water bodies and the study of aquatic plant growth and benthic communities. The ERTS program is investigating satellite applications of monitoring the earth's resources, the satellite offers the enhancement of data in the temporal mode with periodic remote sensing of most of the earth's surface. Author

N73-27322# National Oceanic and Atmospheric Administration, Rockville, Md.
INTERNATIONAL FIELD YEAR FOR THE GREAT LAKES
Joseph MacDowall Sep. 1972 124 p refs Jointly sponsored by Can. and US Natl. Comm. for Intern. Hydrological Decade
(IFYGL-BULL-4) Avail: NTIS HC $8.25

The findings of the International Field Year for the Great Lakes are presented. The subjects discussed are: (1) atmospheric water balance, (2) remote sensing, (3) micrometeorological project, (4) radar observing and data processing system, (5) Canadian data management procedures, and (6) thermal structure and heat content of Lake Ontario. Author

N73-27323# Commonwealth Scientific and Industrial Research Organization, Cronulla (Australia).
GEOPOTENTIAL TOPOGRAPHIES AND CURRENTS OFF WEST AUSTRALIA, 1965-1969
B. V. Hamon 1972 13 p refs
(CSIRO-DFO-TP-32; ISBN-0-643-00012-7) Avail: NTIS HC $3.00

Dynamic height anomalies for the sea surface and the 300-decibar surface, relative to 1300 db, are presented and discussed for nine cruises. The seasonal variation in dynamic height at 32 S., 112 E. is shown, based on all available data. The main conclusions are (1) the circulation is variable, but less intense than off the east coast of Australia, (2) seasonal effects are small compared to the non-seasonal variability, (3) there is no sign of a regular north-flowing west Australian current in the dynamic topographies of individual cruises. Author

N73-27324# Joint Publications Research Service, Arlington, Va.
DEEP-SEATED HEAT FROM THE EARTH
I. M. Dvorov 12 Jul. 1973 148 p refs Transl. into ENGLISH from the book "Glubinnoye Teplo Zemli" Moscow, Nauka, 1972 p 9-104 and 141-205
(JPRS-59496) Avail: NTIS HC $9.50

Basic scientific trends are discussed, such as: regional distribution and conditions of geothermal field formation in a zone accessible to direct measurements; development and improvement of the equipment and procedures in geothermal observations; deep-seated thermal processes; and social-economic utilization of earth's heat. Author

N73-27325*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MODELS OF EARTH'S ATMOSPHERE (90 TO 2500 km) Space Vehicle Design Criteria (Environment)
Washington Mar. 1973 63 p refs Revised
(NASA-SP-8021) Avail: NTIS HC $3.00 CSCL 04A

This monograph replaces a monograph on the upper atmosphere which was a computerized version of Jacchia's model. The current model has a range from 90 to 2500 km. In addition to the computerized model, a quick-look prediction method is given that may be used to estimate the density for any time and spatial location without using a computer. Author

N73-27326*# Washington Univ., Seattle. Coll. of Forest Resources.
IONIC MIGRATION AND WEATHERING IN FROZEN ANTARCTIC SOILS
Fiorenzo C. Ugolini and Duwayne M. Anderson (Army Cold Regions Research and Engineering Lab.) Washington NASA Jul. 1973 26 p refs

(Grant NGR-50-001-153)
(NASA-CR-2283) Avail: NTIS HC $3.00 CSCL 08M

Soils of continental Antarctica are forming in one of the most severe terrestrial environments. Continuously low temperatures and the scarcity of water in the liquid state result in the development of desert-type soils. In an earlier experiment to determine the degree to which radioactive Na(Cl-36) would migrate from a shallow point source in permafrost, movement was observed. To confirm this result, a similar experiment involving (Na-22)Cl was conducted. Significantly less movement of the Na-22 ion was observed. Ionic movement in the unfrozen interfacial films at mineral surfaces in frozen ground is held to be important in chemical weathering in Antarctic soils. Author

N73-27327# Bureau of Mines, Minneapolis, Minn. Mining Research Center.
ROCK DAMAGE FROM SMALL CHARGE BLASTING IN GRANITE
James J. Olson, Robert J. Willard, David E. Fogelson, and Kenneth E. Hjelmstad 1973 44 p refs
(BM-RI-7751) Avail: NTIS HC $4.25

Density analysis of quartz grains in thin sections and diametric pulse velocity measurements along preblast and postblast cores was used to determine the nature and extent of rock damage produced by small (0.25-, 0.50-, 1.0-, and 2.0-kg) charges of high intensity explosive (C-4) in granite. Pulse velocities from the postblast cores were significantly lower than velocities from the preblast cores and, with the core logs, provided clear identification of the upper and sometimes the lower limits of most severe damage. These zones ranged from about 1.68 ft for the 0.25-kg blast to 4.16 ft for the 2.0-kg blast. Microfracture densities from postblast cores were significantly higher and more variable than densities measured from preblast cores. The microfracture density measurements showed that microscopic damage was present far past the zones of most severe damage as delineated by the pulse velocity logs and core logs. Author

N73-27328# TRW Systems Group, Redondo Beach, Calif.
OCEAN COLOR DATA ANALYSIS APPLIED TO MOCS AND SIS DATA
R. C. Ramsey and P. G. White Jul. 1973 81 p refs Original contains color illustrations
(Contract N62206-72-C-0037)
(TRW-21123-6001-RU-00) Avail: NTIS HC $6.25

Multichannel ocean color sensor data are presented in the form of false color maps. During the data processing to obtain the color maps, a color elevation angle correction has been applied to eliminate the problem of shading. Computer programs used in the data analyses are described, and a novel technique for reducing ocean color data using second derivatives of the spectral curves is reported. G.G.

N73-27329*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
OBSERVABILITY OF HIGH ALTITUDE ATMOSPHERIC SCATTERING LAYERS
Derek M. Cunnold [1972] 31 p refs Revised
(Contract NAS1-9984)
(NASA-CR-112309; AIAA-Paper-71-1110) Avail: NTIS HC $3.75 CSCL 04A

The observability of high altitude aerosol and atmospheric scattering layers by a satellite-mounted optical detector was considered. In particular the detectability of a 50 km layer with a wide-angle receiver was investigated. It was found that a layer possessing an optical depth greater than approximately 0.0002 at 3000 A (i.e. strong enough to affect BUV measurements of ozone) should be detectable with such an instrument provided that the system can be constructed so as to be sensitive to a signal of only 0.0001 of the sunlight directly incident on the instrument. However it was concluded that a narrow field-of-view satellite-mounted telescope used to scan the earth's horizon has a more general applicability for the detection of high altitude aerosol layers. Author

N73-27330*# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
AEROSOL PHYSICAL PROPERTIES FROM SATELLITE HORIZON INVERSION Final Report
Carlton R. Gray, Harvey L. Malchow, Dennis C. Merritt, Robert E. Var, and Cynthia K. Whitney Jul. 1973 215 p refs Prepared in cooperation with Charles Stark Draper Lab., Inc.
(Contract NAS1-11092)
(NASA-CR-112311; R-758; AER-24-F) Avail: NTIS HC $12.75 CSCL 04A

The feasibility is investigated of determining the physical properties of areosols globally in the altitude region of 10 to 100 km from a satellite horizon scanning experiment. The investigation utilizes a horizon inversion technique previously developed and extended. Aerosol physical properties such as number density, size distribution, and the real and imaginary components of the index of refraction are demonstrated to be invertible in the aerosol size ranges (0.01-0.1 microns), (0.1-1.0 microns), (1.0-10 microns). Extensions of previously developed radiative transfer models and recursive inversion algorithms are displayed. Author

N73-27331*# Pakistan Space and Upper Atmosphere Research Committee, Karachi.
UPPER ATMOSPHERE WIND AND TEMPERATURE STRUCTURE AT SONMIANI DERIVED FROM THE ROCKET GRENADE EXPERIMENTS CONDUCTED DURING 1965 - 1967
M. Rahmatullah Mar. 1972 38 p refs Sponsored by NASA
(NASA-CR-133401; W-118) Avail: NTIS HC $4.00 CSCL 04A

The grenade-TMA firing conducted in 1965-1967 bring out the following important features regarding the stratospheric circulation in the subtropics: (1) The temperature pattern during the month of March/April at Sonmiani is characterized by higher temperature than the corresponding CIRA 1965 value. (2) Double maxima in temperature has often been observed during spring. (3) In March the zonal wind is predominantly westerly reaching a maximum value of about 45 m/s at 55 km. (4) The meridional component exhibits oscillatory character between 45 and 60 kms. (5) The change from winter westerlies to summer easterlies first occurred around 50 km during April and gradually affected higher levels as the month progressed. (6) The height of the principal maxima at Sonmiani is located at 105 + or - 5 km. In autumn the wind at the principal maxima is below 100 m/s and is directed to NW, in spring it is of the order of 118 m/s but directed to E or NE. Author

N73-27332*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
NOTES FOR THE IMPROVEMENT OF A REMOTE SENSING MULTISPECTRAL DATA NON-SUPERVISED CLASSIFICATION AND MAPPING TECHNIQUE
Charles C. Dalton 27 Jul. 1973 33 p refs
(NASA-TM-X-64762) Avail: NTIS HC $3.75 CSCL 08B

Examined are: (1) the sequential clustering technique for the unsupervised automatic classification and mapping of earth resources satellite data, (2) theoretical analysis of the tests which were used, and (3) dervation of an alternative set of tests and their necessary algorithm. Author

N73-27333*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DYNAMICS AND MORPHOLOGY OF BEAUFORT SEA ICE DETERMINED FROM SATELLITES, AIRCRAFT, AND DRIFTING STATIONS
W. J. Campbell (Geological Survey, Takoma, Wash. and Univ. of Puget Sound, Takoma, Wash.), P. Gloersen, W. Nordberg, and T. T. Wilheit Jun. 1973 33 p refs Submitted for publication
(NASA-TM-X-66291; X-650-73-194) Avail: NTIS HC $3.75 CSCL 08L

A series of measurements from drifting stations, aircraft, the ERTS-1, Nimbus 4, and Nimbus 5 satellites have jointly provided a new description of the dynamics and morphology of the ice cover of the Beaufort Sea. The combined analysis of these data show that the eastern Beaufort Sea ice cover is made up of large multiyear floes while the western part is made of small, predominantly first-year floes. The analysis suggests that this distribution might be quasi-steady and that the dynamics and thermodynamics of the region are more complex than hitherto known. The measurements consist of: (1) high resolution ERTS-1 imagery which is used to describe floe size and shape distribution,

short term floe dynamics, and lead and polynya dynamics; (2) tracking by Nimbus 4 of IRLS drifting buoys to provide ice drift information which enhances the interpretation of the ERTS-1 imagery; (3) Nimbus 5 microwave (1.55 cm wavelength) imagery which provides synoptic, sequential maps on the distribution of multiyear and first-year ice types; (4) airborne microwave surveys and surface based observations made during 1971 and 1972 in conjunction with the AIDJEX (Arctic Ice Dynamics Joint Experiment) program. Author

N73-27334*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EARTH'S ISOSTATIC GRAVITY ANOMALY FIELD: CONTRIBUTIONS TO NATIONAL GEODETIC SATELLITE PROGRAM
M. A. Khan Jun. 1973 33 p refs Submitted for publication
(NASA-TM-X-66292; X-592-73-199) Avail: NTIS HC $3.75 CSCL 08N

On the assumption that the compensation for the topographic load is achieved in the manner of Airy-Heiskenenan hypothesis at a compensation depth of 30 kilometers, the spherical harmonic coefficients of the isostatic reduction potential U are computed. The degree power spectra of these coefficients are compared with the power spectra of the isostatic reduction coefficients given by Uotila. Results are presented in tabular form. Author

N73-27335*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GLOBAL CHARACTERISTICS IN THE DIURNAL VARIATIONS OF THE THERMOSPHERIC TEMPERATURE AND COMPOSITION
H. G. Mayr, A. E. Hedin, C. A. Reber, and G. R. Carignan (Michigan Univ.) May 1973 43 p refs
(NASA-TM-X-66295; X-621-73-136) Avail: NTIS HC $4.25 CSCL 04A

Global characteristics in the diurnal components of OGO-6 neutral mass spectrometer measurements near 450 km are discussed qualitatively as well as quantitatively on the basis of a theoretical model. Observations and conclusion are summarized: (1) During equinox the temperature maximum occurs after 1600 LT at the equator and shifts toward 1500 LT at the poles, while the oxygen concentration at 450 km peaks about one hour earlier. (2) There is general agreement between the magnitudes and phases of the diurnal, semidiurnal and terdiuranal temperature components at 450 km from theory as well as OGO-6 and radar backscatter measurements. (3) The maximum in the diurnal variation of He is observed near 1030 LT consistent with theoretical results which further emphasize the importance of dynamics and diffusion. (4) During solstice conditions the diurnal temperature maximum shifts toward later local times, in substantial agreement with radar temperature measurements. (5) the temperature-oxygen density phase difference at 450 km is observed to decrease with latitude from the winter toward the summer hemisphere, where oxygen may even peak after the temperature at high latitudes. Author

N73-27336*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SIMULTANEOUS OBSERVATION SOLUTIONS FOR NASA-MOTS AND SPEOPT STATION POSITIONS ON THE NORTH AMERICAN DATUM
J. S. Reece (Computer Sci. Corp., Falls Church, Va.) and J.G. Marsh Jun. 1973 29 p refs Submitted for publication
(NASA-TM-X-66297; X-592-73-170) Avail: NTIS HC $3.50 CSCL 08N

Simultaneous observations of the GEOS-I and II flashing lamps by the NASA MOTS and SPEOPT cameras on the North American Datum (NAD) were analyzed using geometrical techniques to provide an adjustment of the station coordinates. Two separate adjustments were obtained. An optical data only solution was computed in which the solution scale was provided by the Rosman-Mojave distance obtained from a dynamic station solution. In a second adjustment, scaling was provided by processing simultaneous laser ranging data from Greenbelt and Wallops Island in a combined optical-laser solution. Comparisons of these results with previous GSFC dynamical solutions indicate an rms agreement on the order of 4 meters or better in each coordinate. Comparison with a detailed gravimetric geoid of North America yields agreement of 3 meters or better for mainland U.S. stations and 7 and 3 meters, respectively, for Bermuda and Puerto Rico. Author

N73-27337*# California Inst. of Tech., Pasadena.
GRAVITATIONAL-WAVE OBSERVATIONS AS A TOOL FOR TESTING RELATIVISTIC GRAVITY
Douglas M. Eardley, David L. Lee, and Alan P. Lightman Jun. 1973 44 p refs
(Grants NGR-05-002-256; NSF GP-36687X; NSF GP-28027) (NASA-CR-133411; OAP-325) Avail: NTIS HC $4.25 CSCL 08N

Gravitational radiation in the far field was examined using a formalism that encompassed all metric theories of gravity. There are six possible modes of polarization, which can be completely resolved by feasible experiments. A theoretical framework is set forth for classification of waves and theories, based on the Lorentz transformation properties of the six modes. Also shown in detail is how the six modes may be experimentally identified and to what extent such information limits the correct theory of gravity. Author

N73-27338*# Stanford Univ., Calif. Inst. for Plasma Research.
THE RELATION BETWEEN THE AZIMUTHAL COMPONENT OF THE INTERPLANETARY MAGNETIC FIELD AND THE GEOMAGNETIC FIELD IN THE POLAR CAPS
Leif Svalgaard May 1973 49 p refs Presented at 7th ESLAB Symp., Saulgau, West Germany, 22-25 May 1973
(Contract NGR-05-020-559; Contract N00014-67-A-0112-0068; Grant NSF GA-31138)
(NASA-CR-133273; SU-IPR-521) Avail: NTIS HC $4.50 CSCL 08N

The recently discovered relation between the azimuthal component of the interplanetary magnetic field and magnetic variations in the earth's polar caps is reviewed. When the IMF azimuthal component is positive (typical of an interplanetary sector with magnetic field directed away from the sun) geomagnetic perturbations directed away from the earth are observed within 8 deg from the corrected geomagnetic pole. When the IMF azimuthal component is negative (typically within toward sectors) the geomagnetic perturbations are directed towards the earth at both poles. These perturbations can also be described by an equivalent current flowing at a constant magnetic latitude of 80 - 82 deg clockwise around the magnetic poles during toward sectors and counterclockwise during away sectors. This current fluctuates in magnitude and direction with the azimuthal component of the IMF, with a delay time of the order of 20 minutes. The importance of this effect for understanding of both solar magnetism and magnetospheric physics is stressed in view of the possibility for investigating the solar sector structure during the last five sunspot cycles. Author

N73-27339*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
INVESTIGATIONS OF EARTH DYNAMICS FROM SATELLITE OBSERVATIONS
Edward M. Gaposchkin Mar. 1973 59 p refs
(Grant NGR-09-015-103)
(NASA-CR-133414) Avail: NTIS HC $5.00 CSCL 08K

The consequences of the earth's elasticity are examined for close-earth satellites. The ideas of polar motion and earth tides are developed in a form applicable to satellite studies, since the polar motion, the body tide, and the ocean tide are all suitable for study by use of satellites. Analysis of available polar-motion data is performed. Author

N73-27340# European Space Research Inst., Frascati (Italy).
OPTIMISATION AND DATA ANALYSIS OF THE FRASCATI GRAVITATIONAL WAVE DETECTOR
D. Bramanti, K. Maischberger, and D. Parkinson May 1973 15 p refs Submitted for publication Sponsored partly by Max-Planck-Inst. fuer Phys. und Astrophys.
Avail: NTIS HC $3.00

The signal to noise ratio of the gravitational wave detector was optimized by attaching the transducers to the antenna and by matching the transducer impedance to the preamplifier input stage. A computer program studies the detector noise and

produces histograms of the energy distribution and of changes in the phase plane. The sensitivity of the detector is discussed by using an example of the phase plane histogram.
Author (ESRO)

N73-27341# Weapons Research Establishment, Adelaide (Australia).
MEASUREMENTS OF THE BASIC ATMOSPHERIC PARAMETERS AT WOOMERA USING THE FALLING SPHERE, FEBRUARY TO JUNE 1972
P. H. O. Pearson Jan. 1973 58 p refs
(WRE-TN-787) Avail: NTIS HC $5.00

During the first half of 1972 falling sphere experiments were continued on a monthly basis at approximately 6 deg solar depression in the evening about 30 min after sunset. Six results are presented for atmospheric density, temperature, pressure, and wind components covering an altitude band of 30 to 100 km. Density, temperature, and pressure values are compared with those given by relevant models of the atmosphere.
Author (ESRO)

N73-27342# Institut Royal Meteorologique de Belgique, Brussels.
IONOSPHERIC AND COSMIC RAY OBSERVATIONS Monthly bulletin, Dec. 1972 [OBSERVATIONS IONOSPHERIQUES ET DU RAYONNEMENT COSMIQUE BULLETIN MENSUEL, DECEMBER 1972]
Dec. 1972 31 p In FRENCH and DUTCH
Avail: NTIS HC $3.75

Results of ionospheric and cosmic ray (neutron component) observations at Dourbes (Belgium) are tabulated for December 1972.
ESRO

N73-27343# Institut Royal Meteorologique de Belgique, Brussels.
IONOSPHERIC AND COSMIC RAY OBSERVATIONS Monthly bulletin, Nov. 1972 [OBSERVATIONS IONOSPHERIQUES ET DU RAYONNEMENT COSMIQUE BULLETIN MENSUEL, NOVEMBER 1972]
Nov. 1972 31 p In FRENCH and DUTCH
Avail: NTIS HC $3.75

Results of ionospheric and cosmic ray (neutron component) observations at Dourbes (Belgium) are tabulated for November 1972.
ESRO

N73-27344# Kiruna Geophysical Observatory (Sweden).
UNUSUAL BEHAVIOUR OF THE IONOSPHERIC ELECTRON CONTENT DURING THE MAGNETIC STORM, 14-17 DECEMBER 1971
Sixten Olsson Apr. 1972 9 p refs
(KGO-728) Avail: NTIS HC $3.00

Diurnal and storm electron content variations in the winter emphasizing a storm period in the middle of December 1971 are reported. Beacon transmission from the geostationary satellite intelsat 2 F-2 were used. The polarization plane orientation at 136.980 MHz was measured continually during the period 3 December 1971 to 3 January 1972 at Kiruna, using modified Titheridge type polarimeters.
ESRO

N73-27345# Defense Mapping Agency Aerospace Center, St. Louis, Mo. Technical Translation Branch.
ON THE NATURE OF THE EXTENSIVE GRAVITATIONAL ANOMALIES OF THE UKRAINIAN SHIELD
G. Ya. Colizdra and A. K. Akhmetshina Feb. 1973 24 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Fiz. Zemli (Moscow), no. 8, 1972 p 91-99
(AD-757540; DMAAC-TC-1886) Avail: NTIS HC $3.25 CSCL 08/5

The idea of the present article is that the extensive maximums in the Ukrainian shield are not connected with a continuous development of dense rocks, but only with their impregnation. However, on the average, the density of rocks within the maximums has an increased value in comparison with the surrounding territory. The main content of the present report is based on a corresponding model of the crustal structure.
Author (GRA)

N73-27346# Woods Hole Oceanographic Institution, Mass.
STRUCTURAL FRAMEWROK OF THE SUNDA SHELF AND VICINITY Technical Report, Jan. 1971 - Jan. 1973
Zvi Ben-Avraham Jan. 1973 272 p refs
(Grant NSF GA-27449)
(PB-218671/6; WHOI-73-3) Avail: NTIS HC $3.00 CSCL 08G

The Sunda Shelf is one of the most extensive coherent shelves in the world. A geophysical survey was conducted over the southern Sunda Shelf (Java Sea). Water depth, sediment thickness, and the gravity and magnetic fields were continuously measured. Expendable radiosonobuoys were used for seismic refraction measurements. These geophysical data supplemented by earlier studies over the northern Sunda Shelf and geological data from land areas provide a comprehensive picture of the structural framework of the entire Sunda Shelf. In addition, structural studies over some of the deep-sea floors surrounding the Sunda Shelf to develop an evolutionary scheme of the Sunda Shelf and adjacent deep seas. (Author Modified Abstract) GRA

N73-27347# Oregon State Univ., Corvallis. Dept. of Forest Engineering.
ENERGY EXCHANGE STUDIES AT THE EARTH'S SURFACE. 2: ENERGY BUDGET OF A PUMICE DESERT
H. Richard Holbo Jan. 1973 157 p refs Sponsored in part by Dept. of Interior
(PB-218791/2; OWRR-A-001-ORE(18)-Vol-2; W73-07424; TR-73-2) Avail: NTIS HC $3.00 CSCL 04B

The energy budget of a pumice desert surface was analyzed under clear skies during early, mid- and late summer periods. The pumice site is in the semi-arid plateau region of Central Oregon at an elevation of about 1500 meters.
GRA

N73-27348# Geological Survey, Washington, D.C. Water Resources Div.
URBAN HYDROLOGY: A SELECTED BIBLIOGRAPHY WITH ABSTRACTS
G. L. Knapp and J. P. Glasby Dec. 1972 216 p refs
(PB-219105/4; USGS-WRI-3-72; USGS-WRD-73-003) Avail: NTIS HC $6.75 CSCL 08H

This bibliography of 650 selected references on urban hydrology is intended as a source document for scientific and water-management needs. It was stimulated by increasing interest in the problems of runoff and water quality caused by increasing urbanization. It brings together abstracts with citations that pertain to the rainfall-runoff process, urban groundwater problems, urban water pollution sources, urban climatic changes, and urban runoff modeling. Emphasis is given to technical advances of the past ten years as well as to needs for new research. It is arranged alphabetically by author and has separate geographic and subject indexes. Each abstract is followed by several added key words to relate it to other similar references.
GRA

N73-27349# Emmanuel Coll., Boston, Mass.
HF AND VHF OBLIQUE BACKSCATTER AND SCINTILLATION STUDY Final Report, 15 Jul. 1971 - 14 Jan. 1973
Sunanda Basu, Robert L. Vesprini, and Eileen Marin Jan. 1973 115 p refs
(Contract F19628-71-C-0250)
(AD-760783; AFCRL-TR-73-0207; AF Proj. 414L) Avail: NTIS CSCL 04/1

The research was concerned primarily with HF and VHF oblique backscatter observations, made at Plum Island, Ma. 56 degrees N invariant, over nearly half a solar cycle. The backscatter analysis was performed in two parts. The first part was concerned with the field-aligned irregularities in the E-layer and their association with the ground backscatter echo which are propagated via sporadic E (E(s)) reflection. The second part of the study was concerned with the occurrence characteristics of the field-aligned irregularities in the F-layer and their relationship, if any, to the backscatter signal propagating via the F-layer (1F echo). (Author Modified Abstract)
GRA

N73-27350# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE CONTRIBUTION OF SOLAR PARTICLES TO THE DIURNAL VARIATION OF NEUTRON INTENSITY
G. V. Skripin, G. F. Krymskii, and L. P. Boltrushko 10 May

1973 13 p refs Transl. into ENGLISH from the publ. "Kosmicheskie Luchi i Problemy Kosmofizik" USSR, 1964 p 170-175
(AD-760950; FTD-HT-23-0465-73) Avail: NTIS CSCL 04/1

Since chromospheric flares occur rather frequently, the observed effect of increased intensity during the flares should distort the diurnal variation on individual days, while if solar cosmic rays reach the earth in a highly anisotropic flow, there should also be distortion of the mean diurnal variations, caused by the appearance of an addditional diurnal variation of solar particles. The purpose of the paper is to estimate the contribution of solar particles to both diurnal variations on individual days as well as mean variations. GRA

N73-27351# Princeton Univ., N.J. Plasma Physics Lab.
PLASMA MODIFICATION ASSOCIATED WITH PARAMETRIC INSTABILITIES DRIVEN BY INTENSE ELECTROMAGNETIC WAVES, PART 1. PARAMETRIC INSTABILITIES AND IONOSPHERIC MODIFICATION, PART 2
Hans W. Hendel, C. R. Oberman, F. W. Perkins, and E. J. Valeo Griffiss AFB, N. Y. RADC Mar. 1973 33 p
(Contract F30602-72-C-0053; ARPA Order 1423)
(AD-760809; RADC-TR-73-90) Avail: NTIS CSCL 04/1

In part one, collective plasma phenomena similar to those occurring in the ionosphere upon incidence of intense electromagnetic waves were studied in laboratory Q-device plasmas. Two different propagation schemes have been investigated. In part 2, parametric instabilities, excited in the ionosphere by high power, HF transmitters with a frequency below the maximum ionospheric plasma frequency, produce nonlinear energy absorption and enhanced scattering of electromagnetic radiation which has been detected by the Arecibo Thomson-scatter radar. This paper reviews and extends both the linear and nonlinear saturation theory of parametric instabilities within the ionospheric context. Calculations are presented of the magnitude of the nonlinear energy absorption and of the angular dependence, frequency spectrum, and intensity of scattering from instability-created density fluctuations. (Author Modified Abstract) GRA

N73-27352# Aerospace Corp., El Segundo, Calif. Plasma Research Lab.
SHIELDING LENGTHS IN MAGNETOSPHERIC AND INTERPLANETARY PLASMAS Research Report, Aug. - Oct. 1972
D. P. Cauffman 6 Apr. 1973 29 p refs
(Contract F04701-72-C-0073)
(AD-760795; TR-0073(9220-01)-1; SAMSO-TR-73-168) Avail: NTIS CSCL 04/1

A method is presented for estimating the characteristic shielding length of a spherical object that is immersed in a plasma when photoelectrons are being emitted by the object. In agreement with experimental evidence, the calculation reveals that shielding lengths for small probes are significantly closer to the Debye length than previously thought. These arguments are important for objects 1m or less in diameter that are in the magnetosphere beyond the plasmasphere and in interplanetary space. This method of estimation is specifically applicable to thick sheaths; previous methods have assumed that sheaths would be thin compared with the size of the shielded object. Author (GRA)

N73-27353*# Woods Hole Oceanographic Institution, Mass.
APPLICATION OF SPECTROMETRY TO BIOLOGICAL OCEANOGRAPHY Final Report
George L. Clarke and Gifford C. Ewing Feb. 1973 36 p refs
(Grant NGR-22-014-016; Contract N62306-71-C-0195)
(NASA-CR-133325; AD-758687; WHOI-73-8) Avail: NTIS HC $4.00 CSCL 08/1

The report describes an investigation for measuring ocean color from the air, for correlating it with the physical and biological conditions of the sea, and for interpreting the data obtained. The feasibility of mapping and distinguishing between ocean areas containing low and moderate chlorophyll concentrations from flight altitudes up to 15,000 feet is shown experimentally by means of an airborne spectrophotometer. Author (GRA)

N73-27354# Woods Hole Oceanographic Institution, Mass.
SYNOPTIC VIEW OF THE CARIBBEAN SEA SURFACE TOPOGRAPHY
J. P. Dean and C. B. McCullough Aug. 1972 15 p refs
(Contract N00014-66-C-0241; NR Proj. 083-004)
(AD-759041; WHOI-72-64) Avail: NTIS CSCL 08/10

Theoretical estimates of some factors which affect the topography of the sea surface are given for the Caribbean Sea. Weather and oceanographic effects which act on the ocean surface eventually to be mapped by an orbiting GEOS-C satellite are discussed in terms of their relative magnitudes and general distribution over the area of interest. Author (GRA)

N73-27355# Defense Mapping Agency Aerospace Center, St. Louis, Mo. Technical Translation Branch.
COMMENTS ON THE GEODETIC REFERENCE SYSTEM
Vladimir K. Hristov Jan. 1973 10 p ref Transl. into ENGLISH from Beitr. Geophysik (Leipzig), v. 81, no. 3/5, 1972 p 254-258
(AD-759127; DMAAC-TC-1920) Avail: NTIS CSCL 08/5

The paper is based on two official documents of the IUGG and IAG on the Geodetic Reference System 1967. The author is convinced that in deriving the parameters of the reference ellipsoid and the parameters of the formula for normal gravity, error equations must be set up, which contain all the quantities derived by observation, i.e. geodetic, astronomic, gravimetric, and those obtained by satellite geodesy; here a joint adjustment must be performed. GRA

N73-27356# Oklahoma State Univ., Stillwater.
REMOTE SENSING RESEARCH PROJECT: BIBLIOGRAPHY ON REMOTE SENSING APPLICATIONS IN GEOLOGY AND EARTH SCIENCES Interim Report No. 2
Mohamed Abdel-Hady, Mohamed El-Shazly, and Hassan Mostafa Nov. 1972 358 p refs Prepared in cooperation with Acad. of Sci. Res. and Technol., Cairo
(Grant NSF GF-31866)
(PB-219104/7; IR-2) Avail: NTIS CSCL 08G

Interm reports numbers 1, 2, and 3 together are a comprehensive bibliography of the remote sensing applications to agriculture, civil engineering, and geology. Each volume is divided into annotated and unannotated references. Volume 2, enclosed, is a bibliography on remote sensing applications in geology and earth sciences. Sensing methods are classified into aerial photography, infrared imagery, other remote sensors (radar, ultraviolet, and multispectral), and processing techniques. The following areas are covered in this report in regard to the use of remote sensing techniques in their interpretation: drainage patterns, geomorphology, general geology, hydrogeology, mineral resources, and oceanography. Author (GRA)

N73-27357# Oklahoma State Univ., Stillwater.
REMOTE SENSING RESEARCH PROJECT: BIBLIOGRAPHY ON REMOTE SENSING APPLICATIONS IN AGRICULTURE AND SOIL SURVEY Ingerim Report
Mohamed Abdel-Hady, Ahmed Abdel-Samie, and Hassan Mostafa Sep. 1972 290 p refs Prepared in cooperation with Acad. of Sci. Res. and Technol., Cairo
(Grant NSF GF-31866)
(PB-219103/9; IR-1) Avail: NTIS CSCL 08G

A comprehensive bibliography of the remote sensing applications to agriculture civil engineering, and geology is reported. Each volume is divided into annotated and unannotated references. Volume 1, enclosed, covers items about recent advances in the agricultural applications of infrared and color photography, electronics, side looking airborne radar, short wavelength radiation and multispectral sensing. The references cover special agricultural and soils applications such as crop identification, crop survey, crop disease in agriculture and forestry, soil survey, and drainage studies. Author (GRA)

N73-27358# Army Engineer Topographic Labs., Fort Belvoir, Va.
THE DETERMINATION OF THE ANOMALOUS GRAVITY POTENTIAL FROM SATELLITE AND TERRESTRIAL DATA UNDER UTILIZATION OF MODERN GRAVIMETRIC THEORY
Hans Baussus VonLuetzow Apr. 1973 20 p refs
(AD-759909; ETL-RN-73-2) Avail: NTIS CSCL 08/5

After a review of related work, a first order connection between

a spherical harmonics presentation of the disturbing potential at a height of 9 km above sea level and the anomalous potential at the earth's physical surface based on the theories of Pellinen, Moritz, and the author is facilitated. This is achieved by a topographic correction term applied to the potential at 9 km above sea level, which permits an analytical continuation between the thus modified potential and that expressed by Faye anomalies at the earth's physical surface. In this way, the problem of analytical continuation of free air gravity anomalies is avoided. Furthermore, it is possible to reduce the remaining potential or gravity anomaly variance at 9 km above sea level, associated with higher order harmonics, by corresponding topographic corrections. Author (GRA)

N73-27359# Arizona Univ., Tucson. Office of Arid Lands Studies.
EXPLORATION AND EXPLOITATION OF GEOTHERMAL RESOURCES IN ARID AND SEMIARID LANDS: A LITERATURE REVIEW AND SELECTED BIBLIOGRAPHY Arid Lands Resource Information Paper No. 2
1973 125 p
(Contract DI-14-31-0001-3729)
(PB-218830/8; W73-07420; OWRR-W-144(2)) Avail: NTIS HC $5.45 CSCL 08G

Contemporary techniques for exploration of geothermal resources are outlined, with particular emphasis on the western U.S. as typical of problems encountered in arid and semiarid lands. These include field reconnaissance, infrared aerial reconnaissance, photogeologic mapping, drilling, geochemical analysis of ground water, application of fluid dynamics to natural steam systems, electrical prospecting, seismic, gravity, and magnetic surveys. Environmental impacts, including noise, odors, subsidence, and legal problems involving developmental regulations, are reviewed. (Author Modified Abstract)

N73-27360# Environmental Protection Agency, Washington, D.C. D. C. Library Systems Branch.
SUMMARIES OF FOREIGN GOVERNMENT ENVIRONMENTAL REPORTS, SEPTEMBER 1972 Foreign Documents Announcements
Sep. 1972 20 p refs
(PB-218839/9; EPA/FDA-1) Avail: NTIS HC $3.00 CSCL 13B

Under a series of documents exchange agreements with environmental agencies in other countries, EPA is building a collection of environmental reports issued by foreign governments and international organizations. This is the first in a series of announcements of foreign documents received. The series is devoted to summaries of government reports and concentrates on the legislative, economic and social aspects of environmental pollution. GRA

N73-27361# Environmental Protection Agency, Washington, D.C. D. C. Library Systems Branch.
SUMMARIES OF FOREIGN GOVERNMENT ENVIRONMENTAL REPORTS, DECEMBER 1972 Foreign Documents Announcements
Dec. 1972 16 p refs
(PB-218858/9; EPA/FDA-4) Avail: NTIS HC $3.00 CSCL 13B

Under a series of documents exchange agreements with environmental agencies in other countries, EPA is building a collection of environmental reports issued by foreign governments and international organizations. This is the fourth in a series of announcements of foreign documents received. The series is developed to summaries of government reports and concentrates of the legislative, economic and social aspects of environmental pollution. GRA

N73-27362# Edison Water Quality Lab., N.J.
THE APPEARANCE AND VISIBILITY OF THIN OIL FILMS ON WATER
Aug. 1972 74 p refs
(PB-219825/7; W73-08295; EPA-R2-72-039) Avail: NTIS MF $0.95; SOD HC $2.50 as EPI.23/2:72 039 CSCL 13B

The report examines the inherent optical characteristics and corresponding inherent visual effects of thin films of oil on water. The objective of the laboratory study is to determine the feasibility of visual means of oil spill detection. Factors considered include nature of illumination, sky conditions, sun angle, color and depth of water, color of bottom, and viewing angle. GRA

N73-27363# Kansas State Highway Commission, Topeka.
SOIL IDENTIFICATION BY REMOTE SENSING TECHNIQUES IN KANSAS, PART 1
Alvis H. Stallard and Lewis D. Myers Jul. 1972 109 p refs
Prepared in cooperation with Federal Highway Adm., Wash., D. C.
(PB-22037/6) Avail: NTIS HC $3.00 CSCL 08M

The remote sensing program conducted by the State Highway Commission of Kansas in cooperation with the Federal Highway Administration are reported and results of visual interpretation are presented. Methods of collection and types of data are described including frequency and type of ground observation data. Color aerial photography was the best single source of data for engineering soil mapping. (Author Modified Abstract) (GRA)

N73-27364# Massachusetts Univ., Amherst. Coastal Research Center.
DETAILED ANALYSIS OF SHORT-TERM VARIATIONS IN BEACH MORPHOLOGY (AND CONCURRENT DYNAMIC PROCESSES) FOR SUMMER AND WINTER PERIODS, 1971 - 1972, PLUM ISLAND, MASSACHUSETTS Final Report
Ralph Warren Abele, Jr. Nov. 1972 179 p refs
(Contract DACW72-71-C-0023)
(AD-759513) Avail: NTIS CSCL 08/3

An analysis of the relationship between wave and meteorological variables and beach morphology was undertaken during summer and winter periods, 1971 and 1972, on Plum Island, Massachusetts. Fifteen variables were measured or computed bihourly, twenty-four hours per day, throughout both study periods. These variables were wave period, wave height, breaker type, breaker angle, longshore current velocity, wave steepness, breaker power, wind speed and direction, barometric pressure, air and water temperature, and ground-water elevation. Daily topographic maps of the intertidal zone were constructed for twelve beach profiles spaced at 60-m intervals. Differences in beach morphology within a small area appear to reflect the stage of recovery of the beach profiles following a storm. (Author Modified Abstract) GRA

N73-27365# Ohio State Univ., Columbus. Dept. of Geodetic Science.
DETERMINATION OF SURFACE DENSITIES FROM A COMBINATION OF GRAVIMETRY AND SATELLITE ALTIMETRY
John F. Isner Dec. 1972 69 p refs
(Contract F19628-72-C-0120; AF Proj. 8607)
(AD-759536; DGS-186; AFCRL-72-0743; SR-5) Avail: NTIS CSCL 08/5

The use of satellite altimetry by itself, and in combination with existing gravity material is considered for the determination of the gravity field of the earth. This is done by developing equations that relate surface density values defined in discrete blocks to geoid undulations and gravity anomalies. The use of a higher order reference field defined by a set of spherical harmonics is considered and truncation errors are computed when the contribution of an area outside a spherical cap is obtained from a spherical harmonic expansion of the anomaly field. A suggested solution to recover 5 degree equal area blocks is made with specific recommendations made on the ordering of these blocks so that structured sets of normal equations will result. The determination of a more local field (such as 1 degree) is discussed using the global 5 degrees field as a basis.
Author (GRA)

N73-27366# Ohio State Univ., Columbus. Dept. of Geodetic Science.
THREE-DIMENSIONAL GEODESY AND GRAVITY GRADIENTS
Erik Grafarend Dec. 1972 91 p refs
(Contract F19628-72-C-0120; AF Proj. 8607)
(AD-759538; DGS-174; AFCRL-TR-73-0091; SR-6) Avail: NTIS CSCL 08/5

The report is a foundation of three-dimensional geodesy by means of Nonriemannian differential geometry. Based on the Frobenius integration theorem nonuniqueness, anholonomity or nonintegrability of geodetic measurements in their natural or astronomic reference system are proved. The characteristic Cartan object of anholonomity depends on either the gradients of the geogravity or the gradients of the standard gravity, the vertical deflections and their gradients. The results show the close connection between three-dimensional geodesy and gravity gradients. (Author Modified Abstract). GRA

N73-27367# Pittsburgh Univ., Pa. Atmospheric Sciences Inst.
ATOMIC AND MOLECULAR PROCESSES IN ATMOSPHERIC ENVIRONMENTS Technical Progress Report, 2 Oct. 1972 - 1 Apr. 1973
M. A. Biondi 20 Apr. 1973 33 p refs
(Contract DA-31-124-ARO(D)-440; ARPA Order 826)
(AD-760576; AROD-6563:59-P; TPR-14) Avail: NTIS CSCL 04/1

The report briefly summarizes the author's research progress in the following area: Radiative properties of simple molecules and atoms for optical discrimination studies; Infrared emission from recombination and energy transfer process of air species; Ground based observations, rocket and satellite measurements and aeronomy calculations; and Model calculations of atmospheric composition and response. GRA

N73-27368# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
INSTABILITY OF INTERNAL WAVES IN STRATIFIED JET STREAMS
Z. N. Kogan 5 Feb. 1973 19 p refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 5, 1972 p 12-21
(Contract N00017-72-C-4401)
(AD-761373; APL-CLB-3-T-654) Avail: NTIS CSCL 04/1

The conditions for the existence of unstable or internal waves in a stratified, non-viscous jet stream and the dependence of the wave parameters (growth indices included) on the temperature-wind stratification are studied. The form of the stability boundary is found as a function of wavelength and Richardson number. It is considered that the unstable waves in this scale range can serve as a source of energy for turbulent motions. The results are in agreement with experiment. (Author Modified Abstract) GRA

N73-27369# Florida Univ., Gainesville. Coastal and Oceanographic Engineering Lab.
LABORATORY INVESTIGATIONS OF WHITECAPS, SPRAY AND CAPILLARY WAVES
O. H. Shemdin, R. J. Lai, A. Reece, and G. Tober Dec. 1972 114 p refs
(Contract N62306-71-C-0033)
(AD-759407; TR-11) Avail: NTIS CSCL 08/3

Laboratory investigations of whitecaps, spray and capillary waves were conducted in the wind and wave facility at the University of Florida. The percent whitecap area coverage was obtained by taking photographs of the water surface and calibrating for the photographed area distortion. Spray was measured by using a constant temperature hot-wire anemometer system. Calibration was achieved by generating uniform size drops with capillary tubes of different sizes and a crystal vibrator. Capillary waves were investigated by a laser-optical device with a frequency response greater than 100 Hz. The device was designed for the purpose of investigating the dependence of capillary waves on the wind speed. (Author Modified Abstract) GRA

N73-27370# Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.
APPLICATION OF IMAGE SENSING ARRAYS TO METROLOGY, DETECTION AND MAPPING Interim Report
Eugene S. McVey, Edward A. Parrish, Jr., and Gerald Cook Apr. 1973 103 p refs
(Contract DAAK02-72-C-0090)
(AD-761121; EE-3317-104-73U; ETL-CR-73-5) Avail: NTIS CSCL 08/2

The report covers the third year of a research effort devoted to the study of the application of image sensing arrays and related problems. Recent progress in the areas of optical data acquisition, signal perturbation theory and map processing under computer control is reported. The future work will continue to be concerned with the fundamentals of optical measurements and contributing to the growth of this technology. It is intended that the results of this effort will ultimately be applied to map processing. Author (GRA)

N73-27371# Physical Dynamics, Inc., Berkeley, Calif.
ENERGY SPECTRA OF THE OCEAN SURFACE: AN EIGENMODE APPROACH
Kenneth M. Watson, Bruce J. West, and J. Alex Thomson Griffiss AFB, N. Y. RADC Feb. 1973 70 p refs
(Contract F30602-72-C-0494; ARPA Order 1649)
(AD-759541; PD-72-030; RADC-TR-73-74) Avail: NTIS CSCL 08/3

A set of Hermitian equations is constructed using a mode description of the dynamic equations of the ocean surface. These equations are sufficiently flexible to include the coupling of the ocean surface to the wind, viscous damping and the effects of surface tension as well as the non-linear interactions between surface waves. The system of equations is exact and from them a system of approximate, first-order (in time), finite differential equations is derived and solved numerically. The solutions to these coupled equations provide one with a detailed view of the growth of the non-linear surface waves and energy spectrum with time. Author (GRA)

N73-27372# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
CONSTANT STRAIN-RATE DEFORMATION OF AMPHIBOLE MINERALS
T. P. Rooney and R. E. Riecker 12 Jan. 1973 43 p refs
(AF Proj. 8607)
(AD-760105; AFCRL-TR-73-0045; AFCRL-ERP-430) Avail: NTIS CSCL 08/7

The amphibole minerals, hornblende and tremolite in single-crystal and polycrystalline form, were deformed in compression at confining pressures from 5 to 20 kb and temperatures from 27 to 1200C at a strain rate of 10 to the minus 5th power/sec. Twinning on ((-1),0,1) is the major ductile deformation mechanism below 800C at all confining pressures. Although among the strongest silicates thus far measured, amphiboles show two major weakening mechanisms at elevated temperatures and confining pressures. Author (GRA)

N73-27373# Institute for Defense Analyses, Arlington, Va.
SEA SPECTRA AND RADAR SCATTERING
W. A. Nierenberg and W. H. Munk Aug. 1972 33 p refs
(Contract DAHC15-67-C-0011; Proj. JASON)
(AD-760693; N-817; ISA/HQ-73-150) Avail: NTIS CSCL 08/3

Bistatic radar observation of the power spectrum in ocean wave number space is proposed, and a geometric analysis made of the point mapping from ocean wave spectrum space to delay-Doppler space. In addition, a relationship is found between the Phillips spectrum B constant and the observed HF radar sea return. Author (GRA)

N73-27374# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
VELOCITIES OF ELASTIC WAVES DURING DEFORMATION AND FAILURE OF ROCK SAMPLES BY MEANS OF UNIAXIAL COMPRESSION USING CONFINED PRESSURES UP TO 10,000-100,000 N/M SQUARED
M. P. Volarovich and I. S. Tomashevskaya 21 Mar. 1973 10 p refs Transl. into ENGLISH from the publ. "Problemy Reologii Gornykh Porod" Moscow, 1970 p 38-41
(AF Proj. 7351)
(AD-759393; FTD-HT-23-136-73) Avail: NTIS CSCL 08/7

Establishing a relationship between the velocities of elastic waves and both elastic and residual deformations can be used in the prognosis of earthquakes. In order to study the velocities of elastic waves during the deformation of rock samples under triaxial state of strain, laboratory tests were furnished for the compression of samples under confined pressures. During the tests the stresses, deformations and velocities of longitudinal waves were measured. Tests were run on cylindrical samples with the ratio of the height to the diameter at 2-3. Subject to

testing were basalts, granites, syenites - the most typical rocks comprising the earth's crust, as well as marble which can be easily deformed plastically. GRA

N73-27855* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IONOSPHERIC FADING EFFECTS ON THE EQUATORIAL ZONE
Thomas S. Golden *In its* Significant Accomplishments in Technol., 1972 1973 p 167-170 (For availability see N73-27816 18-34)
CSCL 04A

N73-27858* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BALLOON ATMOSPHERIC PROPAGATION EXPERIMENT MEASUREMENTS
Peter O. Minott *In its* Significant Accomplishments in Technol., 1972 1973 p 179-182 (For availability see N73-27816 18-34)
CSCL 20N

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N73-27375 National Lending Library for Science and Technology, Boston Spa (England).
THE EXISTING STATE OF AFFAIRS WITH REGARD TO THE OVERFLOW SNOW GAUGE
Oka Masayasu [1973] 4 p Transl. into ENGLISH from Weather Service Bull. (Tokyo), v. 39, 1972 p 72-73
(NLL-M-22982-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The development and operation of an overflow snow gauge are discussed. Problems involved in the operation of the gauge are analyzed and recommendations for correcting the problems are reported. An improved method for eliminating freezing of the instrument during normal operation is proposed. Author

N73-27376*# Litton Systems, Inc., Minneapolis, Minn.
APPARATUS FOR SAMPLING PARTICULATES IN GASES Patent
Rex C. Wood, inventor (to NASA) Issued 26 Jun. 1973 8 p Filed 20 Mar. 1972 Supersedes N72-27424 (10 -18, p2427) Sponsored by NASA
(NASA-Case-HQN-10037-1; US-Patent-3,741,001; US-Patent-Appl-SN-235957; US-Patent-Class-73-28) Avail: US Patent Office CSCL 14B

A device for sampling particulates in gases is described. The device is used to obtain samples of the upper atmosphere. The equipment used a common source of gas pressure to provide the driving gas of an air ejector pump. The sample collection cylinder has many slit impactors running longitudinally on the outer surface of a cylinder and terminating just short of each end of the cylinder. P.N.F.

N73-27377* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RESTRAINT SYSTEM FOR ERGOMETER Patent
Raymond L. Gause and Raymond A. Spier, inventors (to NASA) Issued 10 Jul. 1973 5 p Filed 25 Jun. 1971
(NASA-Case-MFS-21046-1; US-Patent-3,744,794; US-Patent-Appl-SN-156725; US-Patent-Class-272-73; US-Patent-Class-35-12C) Avail: US Patent Office CSCL 14B

A restraint system for securing a person to an ergometer while exercising under zero gravity conditions or while operating the ergometer in earth environment in a position other than the upright position. A padded, form-fitting body belt fits around the operator's waist and suspenders are attached to the body belt. The body belt is secured to the ergometer forwardly and rearwardly of the ergometer seat by adjustable belts joined to the body belt and releasably hooked to the ergometer frame.
Official Gazette of the U.S. Patent Office

N73-27378* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
ZERO GRAVITY LIQUID TRANSFER SCREEN Patent
Frank S. Howard, inventor (to NASA) Issued 10 Jul. 1973 5 p Filed 16 Sep. 1971
(NASA-Case-KSC-10626; US-Patent-3,744,738; US-Patent-Appl-SN-180963; US-Patent-Class-244-1SS; US-Patent-Class-244-135; US-Patent-Class-222-414) Avail: US Patent Office CSCL 14B

A liquid transfer device for use in a zero gravity environment, for transferring liquid from one container to another is described. The device includes a spiral shaped screen type member which is carried in the container for collecting the randomly dispersed liquid and transferring such to an exit port.
Official Gazette of the U.S. Patent Office

N73-27379* National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
ACOUSTICAL TRANSDUCER CALIBRATING SYSTEM AND APPARATUS Patent
Thomas L. Lewis and Robert B. Cohn, inventors (to NASA) Issued 10 Jul. 1973 5 p Filed 14 Oct. 1971
(NASA-Case-FRC-10060-1; US-Patent-3,744,294; US-Patent-Appl-SN-189290; US-Patent-Class-73-1DV; US-Patent-Class-340-5C; US-Patent-Class-179-175.1A) Avail: US Patent Office CSCL 14B

An acoustical transducer calibrating system includes a differential pressure actuating device having an inner chamber for applying differential pressures to the transducer, and an outer chamber for vacuum sealing. Mounted within the inner chamber is an electrostatic actuator for exciting the transducer at selected frequencies so that its sensitivity can be determined for different operating ambient pressures.
Official Gazette of the U.S. Patent Office

N73-27380*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MULTIPLATE FOCUSING COLLIMATOR Patent Application
Richard B. Hoover and James H. Underwood, inventors (to NASA) Filed 28 Jun. 1973 13 p
(NASA-Case-MFS-20932-1; US-Patent-Appl-SN-374441) Avail: NTIS HC $3.00 CSCL 14B

An apparatus for scanning relatively small near sources of radiation to obtain the energy distribution wherein a collimator assembly is interposed between a radiation source and a radiation detector is described. The collimator assembly has a plurality of plates aligned in parallel planes with respect to a common axis normal to their centers which have a similar random distribution of apertures, with the apertures of each plate being the same size. The size of respective plates, the size of the apertures of the respective plates, and the spacing between respective plates vary precisely according to a predetermined ratio to produce radiation channels which converge to a focal point through corresponding ones of the similar random distribution of apertures of the plates. The radiation incident to the radiation detector is maximized when the focal point and the radiation source are coincident. NASA

N73-27381*# Minnesota Univ., Minneapolis. Cosmic Physics Group.
ELECTRON-PROTON SPECTROMETER Final Project Report
John R. Winckler May 1973 99 p refs
(Contract NAS5-11687)
(NASA-CR-132786; CR-163) Avail: NTIS HC $7.00 CSCL 14B

An electron-proton spectrometer was designed to measure the geomagnetically trapped radiation in a geostationary orbit at 6.6 earth radii in the outer radiation belt. This instrument is to be flown on the Applications Technology Satellite-F (ATS-F). The electron-proton spectrometer consists of two permanent magnet surface barrier detector arrays and associated electronics capable of selecting and detecting electrons in three energy ranges:

(1) 30-50 keV, (2) 150-200 keV, and (3) < 500 keV and protons in three energy ranges. The electron-proton spectrometer has the capability of measuring the fluxes of electrons and protons in various directions with respect to the magnetic field lines running through the satellite. One magnet detector array system is implemented to scan between EME north and south through west, sampling the directional flux in 15 steps. The other magnet-detector array system is fixed looking toward EME east. Author

N73-27382*# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Lab.
A THREE-STATION LIGHTNING DETECTION SYSTEM
Lothar H. Ruhnke Jul. 1972 46 p refs
(NASA Order C-59753-C)
(NASA-CR-133400; NOAA-TR-ERL-239-APCL-23) Avail: NTIS MF $0.95; SOD HC $0.75 CSCL 14B

A three-station network is described which senses magnetic and electric fields of lightning. Directional and distance information derived from the data are used to redundantly determine lightning position. This redundancy is used to correct consistent propagation errors. A comparison is made of the relative accuracy of VLF direction finders with a newer method to determine distance to and location of lightning by the ratio of magnetic-to-electric field as observed at 400 Hz. It was found that VLF direction finders can determine lightning positions with only one-half the accuracy of the method that uses the ratio of magnetic-to-electric field. Author

N73-27383*# Arizona Univ., Tucson. Lunar and Planetary Lab.
INFRARED SITE TESTING OF MT. LEMMON AND CATALINA OBSERVATORY Final Report
Gerard P. Kuiper 27 Jul. 1973 5 p
(Grant NGR-03-002-270)
(NASA-CR-133415) Avail: NTIS HC $3.00 CSCL 14B

The operation and problems involved with two sky noise meters installed in the Catalina Mountains near Tucson, Arizona are discussed. The instruments were installed at two different locations on Mt. Lemon. It was found that when photometric conditions prevailed, a positive correlation existed between the outputs of the two instruments. In particular, the strongdiurnal effect, in which the sky noise increases abruptly at sunrise and falls markedly after sunset, was reproduced by both instruments. Discrepancies in data recorded by the two instruments are analyzed and possible causes for the discrepancies are proposed. Author

N73-27384# National Oceanographic Instrumentation Center, Washington, D.C.
INSTRUMENT FACT SHEET: MODEL 4100 GRAPHIC RECORDER, EPC LABS., INCORPORATED, BEVERLY, MASSACHUSETTS 01915
Jun. 1973 8 p
(IFS-73010) Avail: NTIS HC $3.00

An electronic data recording device for shipboard oceanographic operations is described. The device is usually operated as part of an overall bathymetric system. The operation of the equipment is analyzed and the results of performance tests are included. Environmental tests of the effects of temperature, humidity, and vibration are reported. Author

N73-27385# National Oceanographic Instrumentation Center, Washington, D.C.
FIELD TEST REPORT ON INTEROCEAN ACOUSTIC RELEASE DEVICES
May 1973 11 p
(RN-1008) Avail: NTIS HC $3.00

Results of tests made in the Gulf of Mexico of three acoustic release devices are summarized. Also, results of a field study carried out to compare the performance of a correlation echo sounder processor to that of a conventional short-pulse echo sounding system are described. A.L.

N73-27386# Joint Publications Research Service, Arlington, Va.
APPLICATION OF DYNAMIC NUCLEAR POLARIZATION TO INCREASE THE SENSITIVITY AND SPEED OF NUCLEAR PROCESSION MAGNETOMETERS
G. V. Skrotskiy, A. P. Stepanov, V. M. Stotskiy, and A. I. Filatov 29 Jun. 1973 52 p refs Transl. into ENGLISH from Geofiz. App. (Leningrad), no. 42, 1970 p 10-57
(JPRS-59393) Avail: NTIS HC $4.75

Nuclear precession magnetometers for measurements on the ground, in outer space, and in water are discussed. Evaluation of these magnetometers over other types is given. Solution of geological problems is also presented. Author

N73-27387# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
METHOD FOR DETERMINING THE RESOLVING POWER OF PHOTOGRAPHIC LENSES
Francis E. Washer, Irvine C. Gardner, and C. E. Kuyatt Jun. 1973 32 p refs Supersedes NBS-Circular-553
(NBS-SP-374; NBS-Circular-553) Avail: SOD HC $3.00 Domestic Postpaid or $2.75 GPO Bookstore as C13.10:374

A method for determining the resolving power of photographic lenses is presented. The system is based on two sets of charts by which the resolving power of the lens may be numerically measured with respect to a definite scale of values. The method for conducting the test is described and the method for interpreting the results is analyzed. Author

N73-27388*# Alaska Univ., College. Geophysical Inst.
[STUDY OF ARTIFICIALLY GENERATED AND NATURAL AURORAS] Final Report
T. Neil Davis Apr. 1973 11 p refs
(Contract NSR-02-001-035)
(NASA-CR-133298) Avail: NTIS HC $3.00 CSCL 14B

The feasibility of generating artificial auroras by injecting electrons into the upper atmosphere was investigated by using an electron accelerator aboard an Aerobee 350 rocket. Four of the artificial auroral rays were detected and recorded by two geophysical sites separated enough to enable the spatial coordinates of the rays to be determined by triangulation. It was found that (1) the beam remained well collimated; (2) most of the initial beam energy was deposited in the atmosphere; (3) plasma instabilities did not play a significant role; and (4) the orientations of the rays were determined with sufficient accuracy to improve the knowledge of the earth's magnetic field over the Virginia coast. The publications resulting from this research are listed. F.O.S.

N73-27389*# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
PRIMARY ELECTRON SPECTROMETER, 18:63 UE: ELECTROSTATIC ANALYZER DESCRIPTION AND ENERGY SPECTRUM DETERMINATION
Morris B. Pongratz Mar. 1973 47 p refs
(Contract NSR-21-002-077; Grant NGR-21-002-008)
(NASA-CR-133409; TN-BN-758) Avail: NTIS HC $4.50 CSCL 14B

The primary electron spectrometer used to detect auroral electrons on sounding rocket 18:63 UE is described. The spectrometer used exponentially decaying positive and negative voltages applied to spherical deflection plates for energy analysis. A method for determining the analyzer response which does not require the assumptions that the ratio of plate separation to mean radius, the entrance or the exit apertures are small is described. By comparison with experiment it is shown that the effect of neither entrance nor exit collimation can be ignored. The experimental and calculated values of the limiting orbits agree well. A non-iterative technique of unfolding the electron differential energy spectrum is described. This method does not require the usual assumption of a flat or histogram-type energy spectrum. The unfolded spectra using both this technique and one which assumes a flat spectrum are compared to actual input spectra. This technique is especially useful in analyzing peaked auroral electron energy spectra. Author

N73-27390*# National Bureau of Standards, Boulder, Colo.
MASS QUANTITY GAUGING BY RF MODE ANALYSIS Interim Report
R. S. Collier, Doyle Ellerbruch, J. E. Cruz, Robert W. Stokes, Philip E. Luft, R. Gordon Peterson, and A. E. Hiester Jun. 1973 184 p refs
(NASA Order T-1738-B)

(NASA-CR-133393; NBSIR-73-318) Avail: NTIS HC $11.25 CSCL 14B

Work done to date is reported concerning Radio Frequency Mass Quantity Gauging. Experimental apparatus has been designed and tested which measures the resonant frequencies of a tank in the time domain. These frequencies correspond to the total mass of fluid within the tank. Experimental results are discussed for nitrogen and hydrogen in normal gravity both in the supercritical state and also in the two phase (liquid-gas) region. Theoretical discussions for more general cases are given. Author

N73-27391*# Maryland Univ., College Park. Dept. of Physics and Astronomy.

Si(Li) POSITION SENSITIVE DETECTOR

Joseph R. Gigante Jan. 1973 33 p refs

(Contract NAS5-11063; Grants NGR-21-002-316; NGR-21-002-224)

(NASA-CR-133408; TR-73-064) Avail: NTIS HC $3.75 CSCL 14B

A position sensitive detector was made using the lithium diffused layer of a lithium-drifted-silicon detector as the uniform resistive layer. An expression is derived for estimating the resistance from the thickness of the lithium layer. Expressions for the noise and ballistic deficit for single differentiation-double integration pulse shaping are presented. Room temperature data for a 1 Mev proton beam on a 45 mm long detector shows that the linearity is better than .05% and that the position resolution is 1.06 + or - .05 mm. Author

N73-27392*# Texas Univ., Austin. Dept. of Astronomy.

INFRARED SITE MONITOR OPERATIONS AT MCDONALD OBSERVATORY Final Report

Harlan J. Smith 16 Apr. 1973 3 p

(Grant NGR-44-012-202)

(NASA-CR-133394) Avail: NTIS HC $3.00 CSCL 14B

The operation, calibration, and maintenance of the infrared monitor are described. F.O.S.

N73-27393# Los Alamos Scientific Lab., N.Mex.

PROPORTIONAL CHAMBERS WITH MONOFILAR HELICAL CATHODES FOR HIGH SPATIAL RESOLUTION

D. M. Lee (Va. Univ.), S. E. Bottka (Va. Univ.), and H. A. Thiessen Mar. 1973 10 p refs

(Contract W-7405-eng-36)

(LA-5195-MS) Avail: NTIS HC $3.00

Multiwire potential chambers with monofilar helical delay line cathodes have been developed. Spatial resolutions better than 0.33 mm FWHM have been achieved. Such chambers are easily constructed and read out and can be adapted to a large variety of geometries. The properties of monofilar helical delay lines are analyzed in detail. Author (NSA)

N73-27394# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).

INTERFEROMETRIC SYSTEM FOR MICROELECTRONIC LARGE SCALE INTEGRATION Final Report [ENSEMBLE INTERFEROMETRIQUE POUR INTEGRATION A GRANDE ECHELLE EN MICROELECTRONIQUE COMPTE-RENDU DE FIN DE CONTRAT]

M. Lacombat and A. Gerard 10 Dec. 1971 62 p In FRENCH; ENGLISH summary

(Contract DGRST-69-01-891-01)

(LCR-71-213/1/R) Avail: NTIS HC $5.25

An XY coordinate translational device with 100 x 100 mm displacement is described. Its principle characteristics are discussed. They include: displacement control by multinode Ne-He laser interferometers with an accuracy of 0.08 micron; automatic stop on a preselected position with an 0.02 micron accuracy. This device is suitable for step and repeat applications, pattern registration, drawing on scale 1, and high accuracy quantitative control of photographic plates. ESRO

N73-27395# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INFRARED INSTRUMENTS IN SPACE

Yu. Safronov 10 May 1973 17 p Transl. into ENGLISH from the publ. "Fizika v Boyu" USSR, 1969 p 107-119

(AD-760951; FTD-MT-24-336-73) Avail: NTIS CSCL 17/5

The report describes the use of infrared reconnaissance satellites for detection of guided missiles and military satellites. GRA

N73-27396# Panametrics, Inc., Waltham, Mass.

DESIGN, FABRICATION AND USE OF AN INSTRUMENT FOR REAL-TIME DETERMINATION OF POLAR ELECTROJET POSITION AND CURRENT PARAMETERS Final Report, 15 Mar. 1973

Bach Sellers, Frederick A. Hanser, and Paul R. Morel Mar. 1973 58 p refs

(Contract F19628-70-C-0224; AF Proj. 7601)

(AD-760767; AFCRL-TR-73-0166) Avail: NTIS CSCL 04/1

An instrument was designed and fabricated for real-time determination of the auroral electrojet current, velocity, and location in order to assist in selection of the optimum launch time for rockets used to study auroral phenomena associated with substorms. The instrument incorporates a small digital computer to calculate these quantities by use of inputs from up to five 3-axis magnetometers. During two on-site applications at Churchill Research Range data from 3-axis magnetometers situated at two different locations on a north-south line from Churchill were used. During the two substorms studied, the jet was located near 140 km altitude and the intensity of each was as high as 0.5 megaamps. In one case, both stations gave results similar to the two station fit, so the jet was well approximated by a line current. In the second case, the data suggest that the current was either a sheet current or a group of filaments. Recommendations are made for increasing the data processing capability of the instrument in order to handle such realistic electrojet configurations in real-time. Author (GRA)

N73-27397# TRW Systems Group, Redondo Beach, Calif. Advanced Technology Staff Group.

NONIMMERSION PULSE-ECHO ACOUSTO-OPTICAL IMAGING NONDESTRUCTIVE TESTING SYSTEM Final Report, 30 Jun. 1970 - 30 Mar. 1973

Navin H. Doshi, Roy A. Smith, Robert L. Johnson, and Pravin G. Bhuta Mar. 1973 74 p refs

(Contract DAAG46-70-C-0103; ARPA Order 1245)

(AD-760554; AMMRC-TR-73-10) Avail: NTIS CSCL 14/2

The technique of Acousto-Optical Imaging (AOI) enables one to see, on a real-time basis, within optically opaque materials and to detect internal or surface flaws and/or other irregularities which might be present. The process uses an ultrasonic beam to probe the object under study. As it interacts with the object, the ultrasonic beam acquires an acoustical picture of the object. This phase of the investigation was devoted to the design and construction of a nonimmersion pulse-echo acousto-optical imaging system. Using the nonimmersion pulse-echo acousto-optical imaging system, images of regular and irregular flaws in specimens were obtained to define the size of the smallest detectable flaw and to measure the accuracy with which depth of flaw can be determined. The report includes a description and operational characteristics of the nonimmersion pulse-echo acousto-optical imaging system. (Author Modified Abstract) GRA

N73-27398# Air Force Weapons Lab., Kirtland AFB, N.Mex.

DESCRIPTION OF THE EQUIPMENT AND MEASUREMENT TECHNIQUES FOR THE AIR FORCE WEAPONS LABORATORY MULTIPLE-BOUNCE REFLECTOMETER Technical Report, Jan. 1971 - Sep. 1972

Michael G. Wetzel and Theodore T. Saito Apr. 1973 51 p refs

(AD-760589; AFWL-TR-73-36) Avail: NTIS CSCL 20/6

Presented is a detailed description of the operation of the Air Force Weapons Laboratory (AFWL) reflectometer and the correct procedure in the measurement technique of mirror reflectivity on this instrument. In addition, a theoretical discussion is presented explaining the principles behind a multiple-bounce reflectometer and how the data are reduced to yield the reflectivity for a sample mirror. A data presentation which compares measurements on the AFWL reflectometer to measurements on other devices for the same mirrors shows that a good understanding of the operation of the equipment and the proper completion of the measurement techniques will yield measurements of the reflectivities of plane and concave spherical mirrors

with an absolute accuracy of 0.001 and a demonstrated precision of 0.0003. Author (GRA)

N73-27399# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE USE OF SCANNING AUGER SPECTROSCOPY FOR SURFACE ANALYSIS M.S. Thesis
Roger L. Counts Mar. 1973 64 p refs
(AF Proj. 4150)
(AD-760550; GE/EE/73-6) Avail: NTIS CSCL 14/2

A scanning Auger microscope was constructed at the Air Force Avionics Laboratory to permit surface analysis of solid state devices. The instrument was operated in a scanning electron microscope mode for initial tests and calibration. Electron gun operation was verified by measuring a beam current of 0.8 microampere. Electron beam diameter was determined to be approximately 20 microns by observing the resolution of the display. A cylindrical mirror analyzer was installed on the electron gun assembly and synchronous detection techniques were used to record Auger spectra. An apparent inability to record Auger peaks was localized to the analyzer. Wiring diagrams and operating instructions were formulated for the use of future operators of the apparatus. Author (GRA)

N73-27400# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
PORTABLE ULTRA-SENSITIVE SUPERCONDUCTING MAGNETOMETER AND GRADIOMETER DEVELOPMENT Final Progress Report, 1 Jan. - 31 Dec. 1972
N. V. Frederick and J. E. Zimmerman 31 Dec. 1972 22 p
(NAonr-18-72)
(AD-759735) Avail: NTIS CSCL 08/4

Contents: Description of the First Field Test of the Fine-Wire Gradiometer New Gradiometer Design; Construction of super-insulated epoxy-glass cryostats; Transverse balance through the use of rotatable vanes; Axial balance. GRA

N73-27401# Army Missile Command, Redstone Arsenal, Ala. Guidance and Control Directorate.
ANALYSIS OF A TWO DIMENSIONAL LAMINAR RATE SENSOR
Paul L. Jacobs 20 Apr. 1973 56 p refs
(DA Proj. 1W5-62603-A-024)
(AD-761092; RG-73-8) Avail: NTIS CSCL 19/4

The report presents a theoretical analysis of two-dimensional laminar jet rate sensor performance. These systems require small, inexpensive, rugged fluidic sensors with low power consumption, low noise, and low sensitivity to environmental disturbances. The analysis makes use of a solution to a submerged jet in a quiescent medium and adapts it with simplifying assumptions to a rotating receiver. The results predict the effects of sensor length, receiver spacing, nozzle dimensions, Reynolds number, and angular rate on sensor output. Optimized performance curves are presented for some typical geometries. GRA

N73-27402# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE DETECTION AND IDENTIFICATION OF MAN-MADE OBJECTS FROM AERIAL RECONNAISSANCE PHOTOGRAPHS M.S. Thesis
John B. Ashbaugh Mar. 1973 107 p refs
(AD-760755; GE/EE/73-1) Avail: NTIS CSCL 14/5

An algorithm is proposed which detects and identifies man-made objects from actual aerial reconnaissance photographs. The objects are detected by cross-correlating the contour map of the digitized photograph against a generalized model for all man-made objects. This model, consisting of only three prototypes, detects objects regardless of their size, shape, and orientation. The boundary of each man-made object is then traced and represented as a parametric set of complex points. This representation is then cross-correlated with prototypes representing different general shapes in order to gain information about the size and shape of the object. This information is then combined with a logical decision process, based on some generalized rules, to classify the objects. The results of this investigation are based on a test set of six actual photographs. The procedure exhibited a detection accuracy of 71% and an identification accuracy of 87%. Author (GRA)

N73-27403# Chain Lakes Research Associates, Inc., Detroit, Mich.
PROBLEMS ENCOUNTERED IN THE DESIGN OF A PORTABLE TRANSMISSOMETER CALIBRATOR Final Report, Feb. 1971 - Oct. 1972
Roger A. Keller, Sr. Oct. 1972 64 p
(Contract DOT-FA71WA-2535)
(AD-757282; FAA-RD-73-7) Avail: NTIS CSCL 20/6

A prototype portable transmissometer calibrator was designed and built using a laser as a projector source. Numerous problems were encountered during the design. Each problem is thoroughly discussed in the report. The amount of field testing performed was limited by the numerous time consuming problems. Field testing results indicate an extrapolation chart will have to be made and verified prior to using this system to calibrate a transmissometer. The system to be discussed appears quite capable of objectively calibrating a transmissometer in all types of weather. Author (GRA)

N73-27831* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MULTISPECTRAL SCANNER (MSS), ERTS-1
Joseph Arlauskas *In its* Significant Accomplishments in Technol., 1972 1973 p 60-62 (For availability see N73-27816 18-34)
CSCL 14B

N73-27832* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TWO-INCH RETURN BEAM VIDICON (RBV) MULTISPECTRAL THREE CAMERA SUBSYSTEM
Oscar Weinstein *In its* Significant Accomplishments in Technol., 1972 1973 p 63-66 (For availability see N73-27816 18-34)
CSCL 14E

N73-27834* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VISIBLE INFRARED SPIN-SCAN RADIOMETER
James E. Phenix *In its* Significant Accomplishments in Technol., 1972 1973 p 71-73 (For availability see N73-27816 18-34)
CSCL 14B

N73-27835* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MULTISPECTRAL IMAGE DISSECTOR CAMERA FLIGHT TEST
Bernard L. Johnson *In its* Significant Accomplishments in Technol., 1972 1973 p 74-76 (For availability see N73-27816 18-34)
CSCL 14E

N73-27836* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VERY HIGH RESOLUTION RADIOMETER
Joseph R. Schulman *In its* Significant Accomplishments in Technol., 1972 1973 p 77-81 (For availability see N73-27816 18-34)
CSCL 14B

N73-27839* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SCIENCE INSTRUMENTATION PACKAGE, LST
George Levin *In its* Significant Accomplishments in Technol., 1972 1973 p 89-92 (For availability see N73-27816 18-34)
CSCL 14B

N73-27840* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GLANCING INCIDENCE TELESCOPES FOR SPACE ASTRONOMY
Jose Alonso, Jr. *In its* Significant Accomplishments in Technol., 1972 1973 p 93-95 (For availability see N73-27816 18-34)
CSCL 20F

N73-27842* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OPTICAL TRACKING TELESCOPE COMPENSATION
James W. Gilbart *In its* Significant Accomplishments in Technol., 1972 1973 p 109-112 (For availability see N73-27816 18-34)
CSCL 20F

N73-27844* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VERY LONG BASELINE INTERFEROMETRY
Irving M. Salzberg *In its* Significant Accomplishments in Technol., 1972 1973 p 116-120 (For availability see N73-27816 18-34)
CSCL 14B

N73-27848* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ATTITUDE COMPUTATION SYSTEM
Roger D. Werking *In its* Significant Accomplishments in Technol., 1972 1973 p 132-135 (For availability see N73-27816 18-34)
CSCL 14B

N73-27853* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ELECTRON BEAM RECORDER IMAGE CORRECTION FOR ERTS
Paul Heffner *In its* Significant Accomplishments in Technol., 1972 · 1973 p 155-158 (For availability see N73-27816 18-34)
CSCL 14B

N73-27854* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A PHOTOGRAPHIC PROCESSING CONTROL METHOD FOR ERTS IMAGERY
Bernard Peavey *In its* Significant Accomplishments in Technol., 1972 1973 p 159-166 (For availability see N73-27816 18-34)
CSCL 14E

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

N73-27404 National Lending Library for Science and Technology, Boston Spa (England).
ARGON ARC WELDING OF COPPER USING COMPLEX ALLOY WIRE
P. Slyshko Jan. 1973 8 p Transl. into ENGLISH from Avtomat. Svarka (Kiev), v. 221, no. 8, 1971 p 49-51
(NLL-DRIC-Trans-3008-(3623.66)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The procedure for argon arc welding of copper using complex alloy wire is discussed. The advantages over gas welding are presented. The results of the selection of special welding material for the argon arc welding of copper and studies of the structure and properties of the metal seam are reported. Author

N73-27405* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
APPARATUS AND METHOD FOR SKIN PACKAGING ARTICLES Patent
Bernhardt Madsen, Edward R. Pozsony, and Everett E. Collin, inventors (to NASA) Issued 17 Jul. 1973 22 p Filed 24 Mar. 1971
(NASA-Case-MFS-20855; US-Patent-3,745,739;
US-Patent-Appl-SN-127647; US-Patent-Class-53-22A;
US-Patent-Class-53-112A; US-Patent-Class-219-348) Avail: US Patent Office CSCL 13D

A system for skin packaging articles including a loading zone for positioning articles to be packaged upon a substrate, a thermoplastic film heating and vacuum operated skin packaging zone for covering the articles with film laminated to the substrate and a slitting zone for separating and trimming the individual skin packaged articles. The articles are passed to the successive zones. The loading zone may be adapted for conveyorized instead of hand loading. In some cases, where only transverse cutting of the film web is necessary, it may be desirable to eliminate the slitting zone and remove the skin packaged article or articles directly from the packaging zone. A conveniently located operating panel contains controls for effecting automatic, semiautomatic or manual operation of the entire system of any portions in any manner desired. Official Gazette of the U.S. Patent Office

N73-27406* Hughes Aircraft Co., Los Angeles, Calif.
INJECTOR FOR USE IN HIGH VOLTAGE ISOLATORS FOR LIQUID FEED LINES Patent
John A. Snyder, inventor (to NASA) Issued 10 Jul. 1973 4 p Filed 7 Oct. 1971 Sponsored by NASA
(NASA-Case-NPO-11377; US-Patent-3,744,510;
US-Patent-Appl-SN-187262; US-Patent-Class-137-154;
US-Patent-Class-137-604; US-Patent-Class-137-1) Avail: US Patent Office CSCL 13I

An improved injector is described for use in introducing fluid substances into feed lines employed in delivering flowing bodies of liquids. The injector includes a porous plug, concentrically related to a feed line, including an internally tapered surface of a truncated conical configuration with an inlet orifice of a first diameter substantially smaller than the first diameter and an external surface circumscribed by an annular chamber containing a body of insulating gas.
Official Gazette of the U.S. Patent Office

N73-27407*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
OPTICAL ROTATIONAL SENSOR Patent Application
John R. Jamieson, Jr. and Jon D. Stigberg, inventors (to NASA) Filed 21 Jun. 1973 12 p
(NASA-Case-KSC-10752-1; US-Patent-Appl-SN-372143) Avail: NTIS HC $3.00 CSCL 13I

A system for detecting defective components of machines is discussed. Emphasis is placed on detecting defects in bearing assemblies used for supporting a rotating shaft in a machine. The system includes an optical sensor which detects the rotation of the shaft of the motor for generating a frequency that can be multiplied or divided to provide synchronization frequencies. An accelerometer is coupled to the motor for sensing vibrations produced by the defective component and feeding the frequencies generated by such to a time averaging signal analyzer for observation. From analyzing the frequencies generated by the various components, defects can be determined. NASA

N73-27408*# General Dynamics/Convair, San Diego, Calif.
DEVELOPMENT OF FORMING AND JOINING TECHNOLOGY FOR TD-NiCr SHEET Contractor Report, Jun. 1971 - Mar. 1973
R. T. Torgerson Apr. 1973 248 p refs
(Contract NAS3-15567)
(NASA-CR-121224) Avail: NTIS HC $14.50 CSCL 13E

Forming joining techniques and properties data were developed for thin-gage TD-NiCr sheet in the recrystallized and unrecrystallized conditions. Theoretical and actual forming limit data are presented for several gages of each type of material for five forming processes: brake forming, corrugation forming, joggling, dimpling and beading. Recrystallized sheet can be best formed at room temperature, but unrecrystallized sheet requires forming at elevated temperature. Formability is satisfactory with most processes for the longitudinal orientation but poor for the transverse orientation. Dimpling techniques require further development for both material conditions. Data on joining techniques and joint properties are presented for four joining processes: resistance seam welding (solid-state), resistance spot welding (solid-state), resistance spot welding (fusion) and brazing. Resistance seam welded (solid-state) joints with 5t overlap were stronger than parent material for both material conditions when tested in tensile-shear and stress-rupture. Brazing studies resulted in development of NASA 18 braze alloy (Ni-16Cr-15Mo-8Al-4Si) with several properties superior to baseline TD-6 braze alloy, including lower brazing temperture, reduced reaction with Td-Ni-Cr, and higher stress-rupture properties. Author

N73-27409*# General Electric Co., Evendale, Ohio. Aircraft Engine Group.
THE DEVELOPMENT AND PRODUCTION OF THERMO-MECHANICALLY FORGED TOOL STEEL SPUR GEARS

E. N. Bamberger Jul. 1973 99 p refs
(Contract NAS3-15338)
(NASA-CR-121227; R73AEG284) Avail: NTIS HC $7.00 CSCL 13I

A development program to establish the feasibility and applicability of high energy rate forging procedures to tool steel spur gears was performed. Included in the study were relatively standard forging procedures as well as a thermo-mechanical process termed ausforming. The subject gear configuration utilized was essentially a standard spur gear having 28 teeth, a pitch diameter of 3.5 inches and a diametral pitch of 8. Initially it had been planned to use a high contact ratio gear design, however, a comprehensive evaluation indicated that severe forging problems would be encountered as a result of the extremely small teeth required by this type of design. The forging studies were successful in achieving gear blanks having integrally formed teeth using both standard and thermo-mechanical forging procedures.
Author

N73-27410*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CORRELATION OF MAGNETIC PERTURBATION INSPECTION DATA WITH ROLLING ELEMENT BEARING FATIGUE RESULTS
R. J. Parker 1973 27 p refs Proposed for presentation at Joint Lubrication Conf., Atlanta, 16-18 Oct. 1973; cosponsored by Am. Soc. of Lubrication Engr. and ASME
(NASA-TM-X-68260; E-7549) Avail: NTIS HC $3.50 CSCL 14D

A magnetic perturbation technique was used to nondestructively detect subsurface nonmetallic inclusions in the inner races of 207-size, deep groove ball bearings. The bearings were fatigue tested at 2750 rpm under a radial load of. The inner races were subsequently sectioned at fatigue spall locations and at magnetic perturbation signal locations. Analyses of the data indicated good correlation between magnetic perturbation signals and inclusion size and location. Exclusion of those bearings that had significant magnetic perturbation signals did not alter the statistical life of the bearings.
Author

N73-27411*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELASTOHYDRODYNAMIC FILM THICKNESS MODEL FOR HEAVILY LOADED CONTACTS
S. H. Loewenthal, R. J. Parker, and E. V. Zaretsky 1973 31 p refs Proposed for presentation at Joint Lubrication Conf., Atlanta, 16-18 Oct. 1973; cosponsored by Am. Soc. of Lubrication Engr. and ASME Prepared in cooperation with Army Air Mobility R and D Lab.
(NASA-TM-X-68267; E-7569) Avail: NTIS HC $3.75 CSCL 11H

An empirical elastohydrodynamic (EHD) film thickness formula for predicting the minimum film thickness occurring within heavily loaded contacts (maximum Hertz stresses above 150,000 psi) was developed. The formula was based upon X-ray film thickness measurements made with synthetic paraffinic, fluorocarbon, Type II ester and polyphenyl ether fluids covering a wide range of test conditions. Comparisons were made between predictions from an isothermal EHD theory and the test data. The deduced relationship was found to adequately reflect the high-load dependence exhibited by the measured data. The effects of contact geometry, material and lubricant properties on the form of the empirical model are also discussed.
Author

N73-27412*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF HIGH SPEED BALL BEARINGS WITH LEAD AND LEAD ALLOY PLATED RETAINERS IN LIQUID HYDROGEN AT 1.2 MILLION DN
David E. Brewe, Herbert W. Scibbe, and Donald W. Wisander 1973 25 p refs Proposed for presentation of Joint Lubrication Conf., Atlanta, 16-18 Oct. 1973, cosponsored by Am. Soc. of Lubrication Engr. and ASME
(NASA-TM-X-68268; E-7573) Avail: NTIS HC $3.25 CSCL 13I

Ball bearings with lead- and lead-alloy-coated retainers were operated in liquid hydrogen at 30,000 rpm under a thrust load of 400 lb. Bearing lives were compared using different: (1) lead- and lead-alloy coatings, (2) coating thicknesses, (3) substrate materials, (4) retainer locating surfaces, and (5) plating techniques. Longer bearing run times were achieved using retainers with a lead-tin-copper alloy coating electroplated onto a leaded-bronze material and an aluminum-bronze alloy. Thirty percent of the bearings tested achieved the desired objective of 10 hours. All of the lead-alloy coated retainers exceeded this objective. A coating thickness of at least 0.0014 in. was used for all bearings exceeding the 10-hour goal.
Author

N73-27413*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A LIFE STUDY OF AISI M-50 AND SUPER NITRALLOY SPUR GEARS WITH AND WITHOUT TIP RELIEF
Dennis P. Townsend and Erwin V. Zaretsky 1973 23 p refs Proposed for presentation at Joint Lubrication Conf., Atlanta, Ga., 16-18 Oct. 1973; sponsored by Am. Soc. of Lubrication Engr. and the ASME
(NASA-TM-X-68269; E-7575) Avail: NTIS HC $3.25 CSCL 13I

Tests were conducted at 170 F with groups of 3.5-in.-pitch-diameter spur gear with and without tip relief made of consumable-electrode vacuum melted (CVM) Spur Nitralloy (5Ni-2Al) and CVM AISI M-50 steel. The AISI M-50 gears without tip relief had lives approximately 50 percent longer than the Super Nitralloy gears without tip relief. However, the Super Nitralloy gears with tip relief had lives equal to the AISI M-50 gears without tip relief. The difference in lives were not statistically significant. All gears failed by classical pitting fatigue at the pitch circle. However, the AIAI M-50 gears with tip relief failed by tooth fracture. AISI M-50 gear sets without tip relief having a spalled gear tooth which were deliberately overrun after spalling had occurred, failed by tooth fracture.
Author

N73-27414*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STUDY OF BALL BEARING TORQUE UNDER ELASTOHYDRODYNAMIC LUBRICATION
D. P. Townsend, C. W. Allen, and E. V. Zaretsky 1973 38 p refs Proposed for presentation at Joint Lubrication Conf., Atlanta, Ga., 16-18 Oct. 1973; sponsored by Am. Soc. of Lubrication Engr. and the ASME
(NASA-TM-X-68271; E-7284) Avail: NTIS HC $4.00 CSCL 11H

Spinning and rolling torques were measured in an angular-contact ball bearing with and without a cage under several lubrication regimes in a modified NASA spinning torque apparatus. Two lubricants were used, a di-2 ethylhexyl sebacate and a synthetic paraffinic oil, at shaft speeds of 1000, 2000, and 3000 rpm and bearing loads from 10 lbs to 90 lbs. An analytical model was developed from previous spinning friction models to include rolling with spinning under lubrication regimes from thin film to flooded conditions. The bearing torque values have a wide variation, under any condition of speed and load, depending on the amount of lubricant present in the bearing. The analytical model compared favorably with experimental results under several lubrication regimes.
Author

N73-27415*# Pratt and Whitney Aircraft, East Hartford, Conn.
DEVELOPMENT OF MAINSHAFT SEALS FOR ADVANCED AIR BREATHING PROPULSION SYSTEMS Final Report, 7 Jul. 1971 - 6 Feb. 1973
L. J. Dobek Mar. 1973 123 p refs
(Contract NAS3-15346)
(NASA-CR-121177; PWA-TM-4683) Avail: NTIS HC $8.25 CSCL 11A

A gas-film face seal design incorporating shrouded Rayleigh step lift pads at the primary sealing face was analyzed for performance over a wide range of gas turbine engine conditions. Acceptable leakage rates and operation without rubbing contact was predicted for engine conditions that included sealed pressures to 500 psi, sliding speeds to 600 ft/sec, and sealed gas temperatures to 1200 F. In the experimental evaluation, measured gas leakage rates were, in general, close to that predicted and sometimes lower. Satisfactory performance of the gas-film seal was demonstrated at the maximum seal seat axial runout expected in present positive contact face seal applications.

Stable operation was shown when testing was performed with air-entrained dirt. Author

N73-27416# Lockheed Missiles and Space Co., Palo Alto, Calif.
DYNAMICS OF A FREE-PISTON EXPANDER-COMPRESSOR
V. B. Gridin, A. Z. Mirkin, L. G. Antipina, and L. G. Antipina [1973] 8 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Moshinostro. (Moscow), no. 5, 1973 p 85-92
Avail: NTIS HC $3.00, National Translations Center, John Crerar Library, Chicago, Illinois 60616

A theoretical investigation of the dynamics of free-piston expander-compressors was conducted. By using a perfected grapho-analytical method of computation, dependences of the number of cycles on the fundamental machine parameter are established. A formula is deduced for the approximate determination of the number of cycles of an expander-compressor. Author

N73-27417*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF LUBRICANT EXTREME PRESSURE ADDITIVES ON ROLLING ELEMENT FATIGUE LIFE
Richard J. Parker and Erwin V. Zaretsky Washington Jul. 1973 23 p refs
(NASA-TN-D-7383; E-7337) Avail: NTIS HC $3.00 CSCL 11H

The effects of surface active additives on rolling-element fatigue life were investigated with the five-ball fatigue tester at conditions where classical subsurface initiated rolling-element fatigue is the sole mode of failure. Test balls of AISI 52100, AISI M-50, and AISI 1018 were run with an acid-treated white oil containing either 2.5 percent sulfurized terpene, 1 percent didodecyl phosphite, or 5 percent chlorinated wax. In general, it was found that the influence of surface active additives was detrimental to rolling-element fatigue life. The chlorinated-wax additive significantly reduced fatigue life by a factor of 7. The base oil with the 2.5 percent sulfurized-terpene additive can reduce fatigue life by as much as 50 percent. No statistical change in fatigue life occurred with the base oil having the 1 percent didodecyl-phosphite additive. The additives used with the base oil did not change the ranking of the bearing steels where rolling-element fatigue life was of subsurface origin.
Author

N73-27418*# Hydraulic Research and Mfg. Co., Valencia, Calif.
ACTIVE-STANDBY SERVOVALUE/ACTUATOR DEVELOPMENT Final Report
Richard K. Masm 30 May 1973 163 p
(Contract NAS8-27838)
(NASA-CR-124299; HR-73700068) Avail: NTIS HC $10.25 CSCL 13K

A redundant, fail/operate fail/fixed servoactuator was constructed and tested along with electronic models of a servovalve. It was found that a torque motor switch is satisfactory for the space shuttle main engine hydraulic actuation system, and that this system provides an effective failure monitoring technique. F.O.S.

N73-27419*# URS/Matrix Co., Huntsville, Ala. Man Systems Div.
DESIGN OF A TERMINAL POINTER HAND CONTROLLER FOR TELEOPERATOR APPLICATIONS Final Report, 25 Apr. 1972 - 25 Jun. 1973
Edward L. Saenger and Walter S. Woltosz 25 Jun. 1973 71 p refs
(Contract NAS8-28760)
(NASA-CR-124307; PRL-360) Avail: NTIS HC $5.75 CSCL 05H

The design is described of a hand controller intended to achieve the highest possible compatibility with the hand of the human operator in a teleoperator system. Concepts drawings and model development are discussed along with the development of a prototype, and the mathematical control laws. F.O.S.

N73-27420*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
DETECTION OF LACK OF FUSION USING OPAQUE ADDITIVES Final Report, 2 Jun. 1972 - 30 Apr. 1973
J. L. Cook 30 Apr. 1973 99 p refs
(Contract NAS8-28708)
(NASA-CR-124332; MDC-G4538) Avail: NTIS HC $7.00 CSCL 13H

Reliable nondestructive inspection for incomplete weldment penetration and rapid oxidation of aluminum surfaces when exposed to the atmosphere are currently two major problems in welded aluminum spacecraft structure. Incomplete-penetration defects are extremely difficult to detect and can lead to catastrophic failure of the structure. The moisture absorbed by aluminum oxide on the surface can cause weldment porosity if the surface is not cleaned before welding. The approach employed in this program to solve both problems was to employ copper as a coating to prevent oxidation of the aluminum. Also, copper was used as an opaque additive in the weldment to enhance X-ray detection in the event of incomplete penetration. Author

N73-27421# Defense Documentation Center, Alexandria, Va.
ARC WELDING (INDUSTRIAL PROCESSING SERIES) Report Bibliography, Jul. 1951 - Jan. 1973
Jun. 1973 89 p refs
(AD-760970; DDC-TAS-73-34) Avail: NTIS CSCL 13/8

The bibliography comprises citations of unclassified reports dealing with arc welding in a series of bibliographies on industrial processing. Some of the topics included are: spot welding, gas metal arc welding, inert gas welding, pulsed arc welding, and gas tungsten arc welding. Corporate Author-Monitoring Agency, Subject, Title, Personal Author, Contract, and Report Number Indexes are included. Author (GRA)

N73-27422# Johns Hopkins Univ., Baltimore, Md. Dept. of Mechanics and Materials Science.
AN ULTRASONIC TECHNIQUE FOR DETECTION OF THE ONSET OF FATIGUE DAMAGE Annual Report, 1 Mar. 1972 - 28 Feb. 1973
Robert E. Green, Jr. and Robert B. Pond, Sr. May 1973 71 p refs
(Contract F44620-71-C-0062; AF Proj. 9782)
(AD-760787; AFOSR-73-0901TR) Avail: NTIS CSCL 14/2

The purpose of the research is to develop an ultrasonic techniques for the detection of the onset of fatigue damage. Particular emphasis is placed on the use of ultrasonic attenuation measurements as a continuous monitor of fatigue damage during cyclic testing of metal specimens. Efforts to date have indicated that the history of attenuation during fatigue of the specimen provide an index as to the onset of failure. Ultrasonic attenuation measurements made simultaneously with fatigue tests on aluminum bars give an early warning of eminent fracture. Such a warning occurs much earlier than detection of energy reflected from a crack by conventional ultrasonic techniques. This is true for specimens which were initially defect free and for those which initially had structural defects. A systematic comparison is being made between ultrasonic attenuation and other ultrasonic techniques, principally surface wave techniques and acoustic emission techniques. Author (GRA)

N73-27423# Columbia Univ., New York. Lubrication Research Lab.
THE EFFECTS ON BEARING LOAD-CARRYING CAPACITY OF TWO-SIDED STRIATED ROUGHNESS
Sang K. Rhow and Harold G. Elrod Apr. 1973 21 p refs
(Contract N00014-67-A-0108-0021; NR Proj. 062-360)
(AD-761169) Avail: NTIS CSCL 13/9

The multiple-scale method which was earlier employed for lubricating films with striated roughness on one of two opposing surfaces is here extended to include striated roughness on both surfaces. In some papers, the transient effects due to the roughness have been neglected. However, the present analysis shows that the term representing these effects is of the same order of magnitude as others retained in the final equation governing the average pressure. As an example, it is shown that, with the same overall roughness characteristics, the load-carrying capacity of an infinitely-wide slider bearing varies according to how the same roughness is distributed on opposing surfaces. Author (GRA)

N73-27424# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF LUBRICATING OILS ON THE LIFE AND RELIABILITY OF MACHINE PARTS
Yu A. Rozenberg 12 Apr. 1973 493 p refs Transl. into ENGLISH from the monograph "Vliyanie Smazochnykh masel na dolgovechnost i Nadezhnost Detalei Mashin" Moscow, 1970 p 1-311
(AD-760945; FTD-HC-23-0733-72) Avail: NTIS CSCL 11/8
Contents: Lubricating oils; The metallic surface; Atomic-molecular interaction during friction and lubrication; The mechanism of oil lubricative action during friction; The effect of oil on friction; The effect of oils on wear; Machine parts as objectives of lubrication; The effect of oils on the operation of gears; The effect of oils on worm gear lubrication; The effect of oils on the operation of anti-friction bearings; The effect of oils on the operation of sliding bearings; The effect of oils on the operation of friction clutches. GRA

N73-27425# General Dynamics/Fort Worth, Tex. Convair Aerospace Div.
STRESS AND STRAIN DISTRIBUTION IN THE VICINITY OF INTERFERENCE FIT FASTENERS Final Report, 29 Aug. - 20 Oct. 1972
Merle Allen and J. A. Ellis 3 Nov. 1972 579 p refs
(Contract F33615-73-C-3026; AF Proj. 1467)
(AD-760570) Avail: NTIS CSCL 13/5
A body of detailed stress and strain distributions in the vicinity of interference fit fasteners has been analytically obtained and is presented. These data, obtained on simple installations, present trends which may be used by designers in determining how or whether to use interference fit fasteners. The analysis was performed with a finite element digital procedure which has the nonlinear constitutive behavior programmed and interrelates internal loading and deformations. Preparations for the analysis of thirty six conditions included analyzing a test article for which good correlations are shown. (Author Modified Abstract) GRA

N73-27426# Franklin Inst. Research Labs., Philadelphia, Pa.
DUAL DIAMETER ROLLER BEARING - 3.5 MILLION DN-600 F Final Report, 23 Jun. 1971 - 31 Dec. 1972
John Rumberger, James Dunfee, Edmund Filetti, and David Gubernick Wright-Patterson AFB, Ohio AFAPL May 1973 190 p refs
(Contract F33615-71-C-1883; AF Proj. 3048)
(AD-760563; FIRL-F-C3132; AFAPL-TR-73-23) Avail: NTIS CSCL 13/9
Five gas turbine engine mainshaft roller bearing configurations were investigated for capability of sustained performance at DN values (Bore in mm x Speed in rpm) from 2 million to 3.5 million and normal operating temperatures to 600F. A unique Dual Diameter Roller was selected for the final analysis of stress and lubrication parameters, design and fabrication. A 140 mm Bore Dual Diameter Roller Bearing operated successfully for 30 min. continuous operation at 25,000 rpm (3.5 million DN) with stabilized outer race temperatures above 525F. Lubrication was with Polyphenyl Ether 5P4E in an air environment. Author (GRA)

N73-27427# North American Aviation Science Center, Thousand Oaks, Calif.
PROCEEDINGS OF THE INTERDISCIPLINARY WORKSHOP ON NONDESTRUCTIVE TESTING-MATERIALS CHARACTERIZATION Final Report
D. O. Thompson Apr. 1973 509 p refs Workshop held at Thousand Oaks, Calif., 13-15 Nov. 1972
(Grant NSF GH-36303)
(AD-760174; AFML-TR-73-69) Avail: NTIS CSCL 14/2
The field of nondestructive testing and materials characterization is examined with emphasis on new approaches that may lead to significantly improved future capabilities. The presentations range from examples of present capabilities and limitations to fields of basic research. The recommendations of four panels are presented for future research and development to advance the present state-of-the-art. Author (GRA)

N73-27829* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MOMENTUM WHEEL WITH MAGNETIC BEARINGS
Leo J. Veillette *In its* Significant Accomplishments in Technol., 1972 1973 p 49-52 refs (For availability see N73-27818 18-34)
CSCL 13I

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

N73-27428 Brown Univ., Providence, R.I.
KINETIC THEORY OF AN OPTICALLY PUMPED GAS LASER OSCILLATOR Ph.D. Thesis
James Joseph Healy 1972 89 p
Avail: Univ. Microfilms Order No. 73-2280
A theoretical description of the steady state operation of an optically pumped gas laser oscillator is presented. The three-level gas is described by a suitably modified form of the Boltzmann equation, and the radiation is described by the equation of radiative transfer. This formulation is intermediate between the rate equation and semi-classical descriptions of laser behavior. Allowing coupling between the gas and the radiation, solutions are obtained for population inversion, gain coefficient, radiative intensity and output power, in terms of the system parameters and spatial variables. The theory gives new insight into the operating characteristics of an optically pumped laser oscillator. The role of Doppler (inhomogeneous) broadening as compared with collisional (homogeneous) broadening is clearly displayed. Futhermore, it was possible to include nonlinear saturation effects due to the lasing radiation in a simple, quantitative fashion. Dissert. Abstr.

N73-27429 Ohio State Univ., Columbus.
POLARIZATION EFFECTS IN PHOTON ECHOES AND IN AN ANISOTROPIC LASER CAVITY Ph.D. Thesis
Ronald Harry Kohl 1972 191 p
Avail: Univ. Microfilms Order No. 73-2041
The results of two investigations are presented. The first is a calculation of the amplitude and polarization of the photon echo producing part of the electric polarization in a resonant medium which was illuminated by two colinear, sequential, saturating, monochromatic light pulses where the largest of the total angular momentum quantum numbers of the two levels involved is 3 or 5/2. All combinations of linearly and circularly polarized input pulses are considered. The second investigation concerns the beat frequency which was observed in a study of a He-Ne-20, internal mirror laser in a transverse magnetic field and which arose from the frequency splitting of the oscillating orthogonal linear polarizations belonging to a single q00 mode. This splitting is found to be caused by a combination of laser cavity and laser medium anisotropies. The cavity induced splitting is found to be caused by permanent and surprisingly similar anisotropies in the two multilayered dielectric laser mirrors.
Dissert. Abstr.

N73-27430# Defence Research Establishment Valcartier (Quebec).
INTERNAL STRUCTURE OF TEA LASER DISCHARGES
T. Tricker Apr. 1973 51 p refs
(DREV-TN-2061/73) Avail: NTIS HC $4.75
The behavior of a system of equations describing the stationary internal structure of a plasma in an homogeneous TEA laser discharge has been investigated using analog and digital computer techniques. Universal curves which apply for any cathode secondary emission factor and enhanced surface flux at the cathode, and which predict the electron and ion densities and the electric field strength in the region of the cathode, have been obtained as a function of the form of the ionization coefficient and the presence of an external volume source term. Author

N73-27431*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ACOUSTICALLY CONTROLLED DISTRIBUTED FEEDBACK

LASER Patent Application
Charles Elachi, inventor (to NASA) Filed 28 Jun. 1973 16 p (Contract NAS7-100)
(NASA-Case-NPO-13175-1; US-Patent-Appl-SN-374423) Avail: NTIS HC $3.00 CSCL 20E

An acoustically controlled distributed feedback laser is described. The laser is capable of being readily tuned over a continuous frequency spectrum, scanned, and/or redirected by controlling an acoustic source. The invention also involves continuous as well as pulsed modes of laser operation. NASA

N73-27432# Joint Publications Research Service, Arlington, Va.
QUASISTATIONARY CO2 LASER WITH PULSED EXCITATION
I. F. Kanayev, E. P. Kruglyakov, and V. K. Malinovskiy 17 May 1973 4 p refs Transl. into ENGLISH from Zh. Prikl. Mekh. Tekh. Fiz. (Moscow), no. 5, 1971 p 171-173
(JPRS-59040) Avail: NTIS HC $3.00

A laser model that combines the advantages of pulsed excitation of molecules in the discharge and nonequilibrium discharge of supersonic flow in a vacuum is described. The experimental apparatus used for the laser output investigation is illustrated. Typical oscillograms of generation power and discharge voltage are shown. Procedures for measuring the amplification coefficient and the evaluation of the lower boundary of total inversion are presented. Author

N73-27433# Lausanne Univ. (Switzerland).
AN ABSOLUTE CALORIMETER FOR HIGH POWER CARBON DIOXIDE LASER
P. Boulanger, A. Heym, J.-M. Mayor, and Z. A. Pietrzyk Jan. 1973 10 p refs Sponsored by the Swiss Natl. Sci. Found.
(LRP-59/73) Avail: NTIS HC $3.00

An easy to operate absolute calorimeter was successfully built and calibrated in order to measure the energy output of a high power infrared TEA CO2 laser. The laser beam is completely absorbed in a plastic foil glued on a copper plate. A thermocouple measures the difference of temperature between two separate sandwiches of plexiglass and copper plates, one of them taken as reference. Tested between 1 and 12 joules at 10.6 microns the device showed an accuracy of 5%. In the best case, the maximum absorbed power could reach 80 MW/sg cm without any visible damage to the calorimeter. Such calorimeters are particularly convenient for the energy measurement of a high power laser with large beam cross-section. Author (ESRO)

N73-27434# Lausanne Univ. (Switzerland). Centre de Recherches en Physique des Plasmas.
A DOUBLE DISCHARGE HIGH POWER TEA CO2 LASER
P. Boulanger, A. Heym, J.-M. Mayor, and Z. A. Pietrzyk Feb. 1973 29 p refs
(LRP-60/73) Avail: NTIS HC $3.50

A double discharge TEA CO2 laser of simple design and easy operation was successfully operated; the output energy was 12 joules, and the power 0.5 gigawatt of linearly polarized light. The influence of the different gas mixtures on the problem of arcs, time delay before lasing, and evolution in time of the the light pulse, were investigated. The addition of xylene made the operation of a long and narrow laser configuration possible. Xylene avoids the formation of arcs in a very efficient way. In a given geometrical electrodes the laser described is capable of a power output of 42 MW per sq cm of the beam cross section. The maximum efficiency is 6.5%. Author (ESRO)

N73-27435# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
EVALUATION OF THREE TECHNIQUES FOR PRODUCING LASER PULSES OF NANOSECOND DURATION Technical Report, 1 Jul. - 31 Dec. 1972
D. Milam, R. A. Bradbury, and C. C. Gallagher 9 Jan. 1973 35 p refs
(ARPA Order 1434; AF Proj. 6100)
(AD-760752; AFCRL-TR-73-0007; AFCRL-PSRP-526; TR-3) Avail: NTIS CSCL 20/5

Three devices, a short-pulse laser, a coaxial Pockel cell shutter, and a single-crystal transmission-line Pockel cell, have been evaluated as techniques for producing laser pulses approximately 1 nsec in duration. The short-pulse laser has produced pulses that range from 0.5 nsec to 2.0 nsec in duration with peak powers from 25 to 300 kW. Pulses 1.8 nsec in duration FWHM (full width at half maximum) with risetime of less than 0.4 nsec have been gated from Q-switched ruby laser pulses by the coaxial shutter, while pulses 1.3 nsec FWHM have been obtained in the same fashion with a transmission-line shutter. Author (GRA)

N73-27436# Aerospace Research Labs., Wright-Patterson AFB, Ohio. Plasma Physics Research Lab.
KINETIC MODEL OF THE CF3 I PHOTODISSOCIATION LASER Final Report, 1 Jul. 1972 - 1 Feb. 1973
Richard D. Franklin Apr. 1973 26 p refs
(AF Proj. 7073)
(AD-760806; ARL-73-0071) Avail: NTIS CSCL 20/5

A model is developed to describe the reaction kinetics of the CF3I flash photolysis iodine laser. All chemical reactions and relaxation processes which are important in the pressure and temperature regimes of laser amplifiers are described. The model was used to compute the laser energy inversion as a function of time. The effects of pumping rate, diluent gas concentration, and temperature on the magnitude and life time of the inversion were studied. (Author Modified Abstract) GRA

N73-27437# Ohio State Univ., Columbus. Electroscience Lab.
INVESTIGATION OF LASER PROPAGATION PHENOMENA Quarterly Technical Report, 1 Apr. 1972 - 31 Mar. 1973
S. A. Collins, Jr. Griffiss AFB, N. Y. RADC Mar. 1973 16 p refs
(Contract F30602-72-C-0305; ARPA Order 1279)
(AD-760548; ESL-3432-4; RADC-TR-73-115; QR-3) Avail: NTIS CSCL 20/6

The report deals with one aspect of restoration of atmospherically degraded images; the problem of defining isoplanatic patch size. The general restoration situation is considered to indicate the situation where the concept of isoplanaticism is appropriate. Then a model is considered and some problems of the Fourier transform technique of defining isoplanatic patch are pointed out. If the degraded reference function is not identical with the point response function then singularities in the spectrum of the intensity of the restored image can give rise to negative image functions. A measure for indexing this effect is indicated.
Author (GRA)

N73-27438# Cornell Univ., Ithaca, N.Y.
RESEARCH ON MOLECULAR LASERS Semiannual Report, 1 Oct. 1972 - 31 Mar. 1973
George J. Wolga, Simon H. Bauer, Ross A. McFarlane, and T. A. Cool 15 Apr. 1973 25 p
(Contract N00014-67-A-0077-0006; ARPA Order 660)
(AD-760701) Avail: NTIS CSCL 20/5

Research concerning molecular and chemical lasers was conducted in the following areas: Measurement of V yield V and V yield R, T rates among hydrogen halide molecules and the temperature dependence of the energy transfer rates previously determined for HF, DF, HF/CO2 DF/CO2 Systems, Vibrational relaxation studies of CO2 in the pressure range 1-100 atm, Chemical laser studies of the reaction of atomic oxygen and acetylene, Computer modeling of the CS2-02 chemical laser system, Chemical laser studies of the reaction of C3O2 with oxygen, Experimental study of the relaxation of CO2(001) and HF(v1) by collisions with H and F atoms, Studies of the influence of the influence of vibrational excitations on the reaction rate of atom exchange reactions e.g., HF(v) + D2 yield HD + DF.
GRA

N73-27439# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
LASER INDUCED DAMAGE IN SOLIDS
David W. Fradlin May 1973 212 p refs
(Contract N00014-67-A-0298-0006; NR Proj. 372-012)
(AD-761168; TR-643) Avail: NTIS CSCL 20/5

Processes that can produce optical damage in transparent insulators are studied in the present work. A general discussion is given of laser induced damage which distinguishes between breakdown from intrinsic processes and damage from absorbing contaminants called inclusions. New and previously published techniques for identifying damage from inclusions are discussed

and applied. A detailed summary of self-focusing theory is given. A series of controlled experiments are described which represent the first unambiguous measurements of an intrinsic damage mechanism at near-infrared and visible frequencies. Finally, a summary of avalanche breakdown theories is presented, and the implications of the experimental data for avalanche theory are discussed. (Author Modified Abstract) GRA

N73-27440# Institute for Defense Analyses, Arlington, Va. Jason Div.
NOTE CONCERNING MULTI-PHOTON IONIZATION BY A LASER BEAM
Kenneth M. Watson Feb. 1973 18 p refs
(AD-760800; P-940; IDA/HQ-73-14997) Avail: NTIS CSCL 07/4

A recent study by Kroll and Watson indicates that collision broadening of lines could greatly enhance multi-photon transitions between discrete molecular states. The implications of this for multi-photon ionization are discussed. Author (GRA)

N73-27441# Harris Electro-Optics Center of Radiation, Ann Arbor, Mich.
HOLOGRAPHIC OPTICAL ELEMENTS Final Report, 17 Jan. - 17 Oct. 1972
W. S. Colburn, Richard G. Zech, and Lynda M. Ralston Wright-Patterson AFB, Ohio AFAL Jan. 1973 170 p refs (Contract F33615-72-C-1156; AF Proj. 6102)
(AD-760561; AFAL-TR-72-409) Avail: NTIS CSCL 14/5

The significance of this research is the evaluation and characterization of possible recording materials for holographic optical elements. Seven recording materials were evaluated for use as holographic optical elements through measurement of holographic sensitometric and readout parameters and investigation of their environmental stability. The seven materials included four volume phase materials, bleached photographic emulsions, dichromated gelatin, photopolymer, and thick thermoplastics; and three thin phase materials, photoresist, iron oxide, and photoplastics. The holographic response of each material was characterized through measurements of exposure sensitivity, diffraction efficiency, signal-to-noise ratio, frequency response, and spectral variation of readout efficiency. Environmental stability was determined by monitoring the holographic parameters over a wide temperature and humidity range, under prolonged UV exposure, and by measuring the nondestructive readout intensity range. (Author Modified Abstract) GRA

N73-27442# Institute for Defense Analyses, Arlington, Va. Jason Div.
INELASTIC ATOM-ATOM SCATTERING WITHIN AN INTENSE LASER BEAM
Norman Kroll and Kenneth M. Watson Feb. 1973 75 p refs (Contract DAHC15-73-C-0200)
(AD-761180; P-933; IDA/HQ-73-14972) Avail: NTIS CSCL 07/4

An analysis is given of multi-photon transitions between discrete quasi-molecular states during the near adiabatic collision of atoms and/or molecules. The variation of level spacing with changing internuclear separation can permit resonance absorption of one or more photons. Sufficiently intense laser beams can also significantly distort the molecular structure to modify potential surfaces, change activation energies, etc. Through these two mechanisms specific chemical reactions in gases can be made to occur with rates that depend on laser power. Author (GRA)

N73-27859* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THEORETICAL AND EXPERIMENTAL COMPARISON OF AN ULTRA-HIGH-SPEED LASER DATA TRANSMISSION SYSTEM
Mona Tycz *In its* Significant Accomplishments in Technol., 1972 1973 p 183-186 (For availability see N73-27816 18-34)
CSCL 20E

N73-27860* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE WAVEGUIDE CO2 LASER
John J. Degnan, III *In its* Significant Accomplishments in Technol., 1972 1973 p 187-190 (For availability see N73-27816 18-34)
CSCL 20E

N73-27861* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE CO2 LASER FREQUENCY STABILITY MEASUREMENTS
Edward H. Johnson, Jr. *In its* Significant Accomplishments in Technol., 1972 1973 p 191-194 (For availability see N73-27816 18-34)
CSCL 20E

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N73-27443 Toledo Univ., Ohio.
FREQUENCY EFFECT OF MAGNETOCRYSTALLINE ANISOTROPY IN NICKEL FERROUS FERRITES Ph.D. Thesis
Charvaka Duvvury 1972 103 p
Avail: Univ. Microfilms Order No. 73-2394

An investigation of the frequency effect was made for several nickel ferrous ferrites by making torque measurements for magnetocrystalline anisotropy on the same arc-image furnace crystals that were used in a microwave resonance experiment earlier. A plot of delta K1 (K1 (torque) - K1 (microwave)) versus the mole fraction of Fe(2) shows a curve with maximum occurring for low Fe(2) at 170 K. This maximum gradually shifts to higher Fe(2) until the variation approaches linearity at 77 K. The delta K1 for these crystals in the temperature range 77 K less than or equal T 300 K are in relatively good agreement with those calcualted from a phenomenological theory which attributed this frequency effect to the relaxation of the Fe(2) ion. The calculated relaxation time was plotted as a function of the mole fraction of Fe(2) for several temperatures between 170 K and 77 K. This shows that higher Fe(2) yields a lower temperature at which the relaxation process begins and is consistent with the observed delta K1 vs. Fe(2) cirves.
Dissert. Abstr.

N73-27444 Brown Univ., Providence, R.I.
ELECTROMAGNETICALLY EXCITED ACOUSTIC STANDING WAVE RESONANCES IN METALS Ph.D. Thesis
Robert Allan Gordon 1972 106 p
Avail: Univ. Microfilms Order No. 73-2275

An historical review of the electromagnetic excitation of sound and a general theoretical treatment of the phenomenon are also given. In addition, the effects of deviations (flaws) from the ideal unstressed flat plate geometry on the acoustic resonances are discussed. A number of metallic properties which can be measured without sample contact using direct sound generation are also considered. Finally, NMR enhancement via the interaction between the self-consistent magnetic fields in the bulk, associated with the acoustic wave, and the nuclear dipole moments was considered. Theoretical calculations are presented which show the feasibility of such a bulk NMR and several attempts to observe NMR enhancement in aluminum, gold, and silver are described.
Dissert. Abstr.

N73-27445 Yale Univ., New Haven, Conn.
LOW ENERGY ELECTRON DIFFRACTION AND AUGER SPECTROSCOPY STUDIES OF THE (100) SURFACES OF ALUMINUM AND ALUMINUM-COPPER ALLOYS Ph.D. Thesis
Dennis Tambaoan Quinto 1972 181 p
Avail: Univ. Microfilms Order No. 73-4

Low energy electron diffraction (LEED) and Auger electron spectroscopy are complementary techniques used to examine the atomic structure and chemical composition of the outermost atomic layers comprising a crystal surface. This work presents a comprehensive set of LEED intensity data from the aluminum (100) surface with a view to testing the validity of current

theoretical and semi-empirical interpretations of intensity profiles. Dissert. Abstr.

N73-27446* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NONDESTRUCTIVE SPOT TEST METHOD FOR MAGNESIUM AND MAGNESIUM ALLOYS Patent
Maywood L. Wilson, inventor (to NASA) Issued 10 Jul. 1973 4 p Filed 16 Jul. 1971
(NASA-Case-LAR-10953-1; US-Patent-3,744,972; US-Patent-Appl-SN-163152; US-Patent-Class-23-230R) Avail: US Patent Office CSCL 11F

A method for spot test identification of magnesium and various magnesium alloys commonly used in aerospace applications is described. The spot test identification involves color codes obtained when several drops of 3 M hydrochloric acid are placed on the surface to be tested. After approximately thirty seconds, two drops of this reacted acid is transferred to each of two depressions in a spot plate for additions of other chemicals with subsequent color changes indicating magnesium or its alloy.
Official Gazette of the U.S. Patent Office

N73-27447# Aeronautical Research Labs., Melbourne (Australia).
TENSILE DEFORMATION AND FRACTURE IN HIGH STRENGTH Al-Zn-Mg ALLOYS
S. P. Lynch Dec. 1972 25 p refs
(ARL/Met-Note-86) Avail: NTIS HC $3.25

The deformation processes involved in the nucleation and propagation of cracks in high strength Al-Zn-Mg alloys is considered, when tested in tension, and the influence of microstructure on these processes is examined. For a superpure alloy, the effects on tensile properties of the width of the precipitate-free zone adjacent to grain boundaries and of the grain-boundary-precipitate characteristics were determined. Tensile properties of superpure and commercial alloys were compared-the commercial alloy, tested in the longitudinal direction, was more ductile for the same heat treatment. A mechanism of fracture is proposed which explains the observed results. Several points of disagreement with earlier proposed deformation and fracture mechanisms are noted and discussed. Author

N73-27448*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OXIDATION AT THROUGH-HOLE DEFECTS IN FUSED SLURRY SILICIDE COATED COLUMBIUM ALLOYS FS-85 AND Cb-752
Stanley R. Levine Washington Jul. 1973 35 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Cleveland
(NASA-TN-D-7324; E-7330) Avail: NTIS HC $3.00 CSCL 11F

Metal recession and interstitial contamination at 0.08-centimeter-diameter through-hole intentional defects in fused slurry silicide coated FS-85 and Cb-752 columbium alloys were studied to determine the tolerance of these materials to coating defects. Five external pressure reentry simulation exposures to 1320 C and 4.7 x 1,000 N/sq m (maximum pressure) resulted in a consumed metal zone having about twice the initial defect diameter for both alloys with an interstitial contamination zone extending about three to four initial defect-diameters. Self-healing occurred in the 1.33 x 10 N/sq m, 1320 C exposures and to a lesser extent in internal pressure reentry cycles to 1320 C and 1.33 x 100 N/sq m (maximum pressure). Author

N73-27449# Joint Publications Research Service, Arlington, Va.
DEFECTOSCOPY OF METALS
A. K. Denel 3 Jul. 1973 300 p refs Transl. into ENGLISH of the book "Defektoskopiya Metallov" Moscow, Izdatelstvo Metallurgiya, 1972
(JPRS-59424) Avail: NTIS HC $17.00

The principles of nondestructive testing of materials and of organization of defectoscopy laboratories at industrial enterprises are discussed. The planning and equipping of plant laboratories for nondestructive testing, of formulation and recording of analyses and required information on safety procedures are presented, as well as brief summarizations of the basic ranges of practical application of defectoscopic instruments and equipment being developed or manufactured by Soviet industry. Author

N73-27450*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
PERFORMANCE CHARACTERISTICS OF ZINC-RICH COATINGS APPLIED TO CARBON STEEL
William J. Paton Washington Jul. 1973 84 p
(NASA-TN-D-7336) Avail: NTIS HC $3.00 CSCL 11F

A program was conducted to evaluate the performance of topcoated and untopcoated zinc-rich coatings. Sacrificial coatings of this type are required for protecting carbon steel structures from the aggressive KSC sea coast environment. A total of 59 commercially available zinc-rich coatings and 47 topcoated materials were exposed for an 18-month period. Test panels were placed in special racks placed approximately 30.5 m (100 feet) above the high tide line at the KSC Corrosion Test Site. Laboratory tests to determine the temperature resistance, abrasion resistance, and adhesion of the untopcoated zinc-rich coatings were also performed. It has been concluded that: (1) The inorganic types of zinc-rich coatings are far superior to the organic types in the KSC environment. (2) Organic zinc-rich coatings applied at 0.1 - 0.15 mm (4-6 mils) film thickness provide better corrosion protection than when applied at the manufacturers' recommended nominal film thickness of .08 mm (3 mils). (3) Topcoats are not necessary, or even desirable, when used in conjunction with zinc-rich coatings in the KSC environment. (4) Some types of inorganic zinc-rich coatings require an extended outdoor weathering period in order to obtain adequate mechanical properties. and (5) A properly formulated inorganic zinc-rich coating is not affected by a 24-hour thermal exposure to 400 C (752 F). Author

N73-27451*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CASTING COPPER TO TUNGSTEN FOR HIGH POWER ARC LAMP CATHODES
Herbert A. Will Washington Aug. 1973 11 p ref
(NASA-TM-X-2865; E-7456) Avail: NTIS HC $3.00 CSCL 11F

A method for making 400-kW arc lamp cathodes is described. The cathodes are made by casting a 1.75-in. diameter copper body onto a thoriated tungsten insert. The addition of 0.5-percent nickel to the copper prevents voids from forming at the copper-tungsten interface. Cathodes made by this process have withstood more than 110 hours of operation in a 400-kW arc lamp. Author

N73-27452*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A SIMPLIFIED DUCTILE-BRITTLE TRANSITION TEMPERATURE TESTER
Alan Arias Washington Aug. 1973 12 p ref
(NASA-TM-X-2853; E-7448) Avail: NTIS HC $3.00 CSCL 11F

The construction and operation of a versatile, simplified bend tester is described. The tester is usable at temperatures from -192 to 650 C in air. Features of the tester include a single test chamber for cryogenic or elevated temperatures, specimen alining support rollers, and either manual or motorized operation. Author

N73-27453# Centre National de la Recherche Scientifique, Paris (France).
DETERMINATION OF O AND N IN ALKALI METALS AND O IN OTHER METALS USING GAMMA ACTIVATION ANALYSIS WITH CHEMICAL SEPARATION OF THE SHORT HALF LIFE ISOTOPES
B. A. Chapignikov, E. D. Malikova, L. L. Kunin, V. N. Samosyuk, A. M. Vasserman, E. V. Frolov, and Kh. V. Evganov 1972 17 p Transl. into FRENCH of Russian report In FRENCH Presented at Intern. Colloq. on the Activation Anal. of Micro-Quantities of Elem. in Very High Purity Inorg. and Org. Substances and in Biol. Media, Saclay, France, 2-6 Oct. 1972
(Conf-721069-24) Avail: AEC Depository Libraries

A method of rapidly separating the short half life isotopes, O-15 and N-13, from alkali metals and O-15 from other metals (steels, Cu, In) was studied in view of determining O and N by

gamma activation analysis in a gamma quanta current using a microtron. NSA

N73-27454# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).

CHEMICAL METAL MACHINING FOR PERFECTION OF AN INDUSTRIAL MANUFACTURING METHOD Final Report [ETUDE DE L'USINAGE DES METAUX PAR VOIE CHIMIQUE EN VUE DE METTRE AU POINT UNE METHODE INDUSTRIELLE DE FABRICATION·RAPPORT FINAL]

C. Lyon 6 Dec. 1971 62 p In FRENCH

(Contract DGRST-69-02-055-00-275-01)

Avail: NTIS HC $5.25

A chemical machining method is described which uses a photosensitive resin as metal coating. After a photographic emulsion passage which suppresses the resin at noninsulated places, the metal is attacked by a suitable chemical reagent which dissolves the metal at places unprotected by resin. Various metals are considered such as steel, Fe-Ni-Co alloys, light alloys, and copper alloys. Various surface treatments are presented and investigated. It was concluded that satisfactory results are obtained with Fe-Ni-Co alloys, steel, copper alloys, and Mo. The importance of the surface treatment is chemical machining of metals is emphasized. ESRO

N73-27455# Imperial Metal Industries, Ltd., Kidderminster (England). Witton Research Services Dept.

STRESS CORROSION OF TITANIUM ALLOYS BY VITON B

I. R. Scholes and R. L. Williams London Min. of Defence Nov. 1972 45 p refs

(Contract MIN-DEF/PE-KR/45/F)

(D-MAT-191; BR34640) Avail: NTIS HC $4.25

The thermal degradation of Viton B and the risk of stress corrosion cracking (SCC) with three titanium alloys were investigated. Results of thermal degradation tests show that decomposition of Viton B is slow at temperatures below 250 C and that above this temperature, evolution of fluoride containing compounds occur rapidly with increasing temperature. Susceptibility of Viton coated samples to SCC increased in the order Ti-5A1-2.5Sn, Ti-6A1-4V, Ti-8A1-1Mo-1V and in the case of vanadium containing alloys was greater for material stressed in the transverse direction than in the longitudinal direction. Some SCC occured with all three alloys at temperatures at and above 250 C. In gereral, the behavior or samples coated with Viton B was similar to that of uncoated samples exposed in the presence of Viton B, but was concluded that some hazard may exist in service if Viton B is applied to or in the vicinity of stressed titanium alloys at temperatures of 200 C or above.

Author (ESRO)

N73-27456# Rolls-Royce, Ltd., Leavesden (England). Small Engine Div.

PROPERTIES OF ELECTRON BEAM WELDMENTS IN 2 1/2 PERCENT Ni-Cr-Mo STEEL AND 18 PERCENT Ni-Co-Mo MARAGING STEEL

A. E. Longley Orpington, Engl. Defence Res. Inform. Centre [1971] 28 p

(Contract KS/1/0496/C.B.43(A)2)

(S/T-Memo-9-71; BR25369) Avail: NTIS HC $3.50

Tensile and axial loading fatigue tests were carried out in order to evaluate the static and fatigue properties of electron beam weldments in two aircraft steels: 2 1/2 Ni-Cr-Mo-S.98 and a double vacuum melted 18% Ni-Co-Mo maraging steel. After welding, a further tempering was effected as soon as possible. The properties of the welds were compared with those of unwelded samples in the same material. No deterioration in static mechanical properties was observed but fatigue tests indicated a drop of about 6% in fatigue strength at 100 million cycles due to welding. Electron beam welding of 18% Ni-Co-Mo maraging steel in the form of 1/4 in. plate was carried out on the material with a variety of pre and post weld heat treatments. The properties of the welds were compared with those of unwelded fully heat treated samples in the same material. Without post weld heat treatment drastic reductions in static and fatigue properties occurred due to welding. ESRO

N73-27457# Rolls-Royce, Ltd., Leavesden (England). Small Engine Div.

AN EVALUATION OF THE PROPERTIES OF DOUBLE MELTED 18 PERCENT Ni Co Mo MARAGING STEEL

A. E. Longley Orpington, Engl. Defence Res. Inform. Centre 1972 87 p

(Contract KS/1/0338/C.B.43(A)2)

(S/T-Memo-3-72; BR28509) HC $6.50

The evaluation of the 18% Ni-Co-Mo maraging steel has demonstrated that provided double vacuum melted stock is used the material possesses excellent static mechanical properties as either bar or forgings. The maintenance of high notched strength and good impact values over a wide temperature range makes the material attractive for structural applications, although the lower modulus of elasticity of maraging steel must be taken into account in design considerations. The fatigue properties of maraging steel in plain bar form were inferior to those of the 5% Cr-Mo-V steel with which it was compared, especially when long lives were considered. However, fatigue evaluation of forgings which took account of stress concentration and directionality effects reduced the inferiority. Structural fatigue testing of complete forgings revealed the maraging steel as possessing superior fatigue properties in the presence of fretting.

Author (ESRO)

N73-27458# British Steel Corp., London (England).

MECHANICAL AND METALLURGICAL FACTORS INFLUENCING THE ASSESSMENT OF DUCTILE FRACTURE RESISTANCE

E. F. Walker and D. Elliott Nov. 1972 8 p refs

(PB-218919; MG/37/72) Avail: NTIS HC $3.00 CSCL 11F

Significant ambiguities can arise in using a failure criterion based solely on crack opening displacement (COD), to describe the conditions for ductile-fibrous fracture. A study of the crack extension mechanisms subsequent to yielding, indicates that account must be taken of both metallurgical and mechanical aspects of the failure process. In acknowledging the need for a simple, yet realistic, laboratory test able to select materials in terms of the conditions for fracture initiation and risk of continued propagation, a definitive energy criterion is presented based on routine, but fully instrumented fracture toughness tests.

Author (GRA)

N73-27459# British Steel Corp., Sheffield (England). Strip Mills Div.

A SELECT BIBLIOGRAPHY OF THE APPLICATION OF THE COMPUTER TO PHYSICAL AND CHEMICAL TESTING IN THE IRON AND STEEL INDUSTRY

Feb. 1973 16 p refs

(PB-219047; DISRA-SM/TN/1/20) Avail: NTIS HC $3.00 CSCL 11F

The bibliography consists of some 88 references, from the published literature, with abstracts where possible. The analytical methods referred to include spectroscopy, chromatography and microscopy and the physical evaluation procedure covered include torsion, creep, fatigue and tensile property tests.

Author (GRA)

N73-27460# British Steel Corp., London (England). Metallurgy Dept.

ACCELERATED TEST TECHNIQUE FOR THE DETERMINATION OF K SUB ISCC IN STEELS

P. McIntyre and A. H. Priest Dec. 1972 14 p refs

(PB-217215/3; MG/31/72) Avail: NTIS HC $3.00 CSCL 11F

A comparison of environmentally activated crack growth in steels exposed to both dry hydrogen sulphide gas and aqueous sodium chloride solution has shown that although the crack velocity in the gaseous environment exceeds that of stress corrosion cracking by over four orders of magnitude the threshold stress intensity value, K sub ISCC, below which no cracking occurs, is identical. This observation is the basis of a proposed accelerated testing technique for the determination of K sub ISCC in which the threshold is determined, as in a conventional fracture toughness test, by increasing the load on a test piece exposed to an environment of hydrogen sulphide until the onset of rapid sub-critical flaw growth. The test duration required to

determine K sub ISCC is thus reduced from many hours to several minutes. Author (GRA)

N73-27461# Naval Research Lab., Washington, D.C.
LIGAMENT INSTABILITY MODEL FOR STRESS CORROSION AND FATIGUE CRACK PROPAGATION IN A 4340 STEEL Interim Report
Joseph M. Krafft and Herschel L. Smith Apr. 1973 48 p refs
(NRL Proj. F01-03; RR0230345)
(AD-761148; NRL-MR-2598) Avail: NTIS CSCL 11/6

The model is one which explains the growth of cracks in terms of the economics of maintaining stability of plastic flow at the crack tip. The material there is taken to be subdivided into tensile elements, units of size d sub T. There instability is induced by corrosion by stress relaxation, by contraction in area due to stretching; their stability is restored by strain hardening, but this requires strain and this, at constant load, crack growth. The model is tested in terms of data on the aqueous stress corrosion cracking and corrosion fatigue crack propagation in an AISI 4340 steel, quenched and tempered back at 204, 316, 427 and 538C. Data from the literature on another 4340 and on A533 B-1 pressure vessel steel is also examined. Tensile as well as cyclic stress-strain curves were analyzed for each material. (Author Modified Abstract) GRA

N73-27462# Denver Research Inst., Colo.
THERMOMECHANICAL PROCESSING OF NICKEL-BASE SUPERALLOYS BY SHOCK WAVE DEFORMATION Final Technical Report, 6 Nov. 1971 - 5 Dec. 1972
R. Norman Orava Mar. 1973 87 p refs
(Contract N00019-72-C-0138)
(AD-761218; DRI-2618) Avail: NTIS CSCL 11/6

An investigation is being conducted to study the synergistic effects of thermal treatment and explosive shock loading on the microstructure and mechanical properties of Udimet 700 and Inconel 718. The influence of such shock thermomechanical processing (TMP) is compared with that of thermal processing alone and of conventional TMP by cold rolling to a reduction equivalent to the transient shock strain. Shock TMP of Udimet 700 led to improvements in tensile strengths at testing temperatures up to 1400F, tensile ductility, toughness, stress-rupture life at 1200 and 1400F, and microstructural stability. Room-temperature strength and toughness of Inconel 718 were increased due to shock TMP. (Author Modified Abstract) GRA

N73-27463# Syracuse Univ., N.Y. Dept. of Chemical Engineering and Materials Science.
THE SIGNIFICANCE OF MATERIAL DUCTILITY TO THE RELIABILITY AND LOAD CARRYING CAPACITY OF PEAK PERFORMANCE STRUCTURES Final Report, 1 Jan. - 31 Dec. 1972
Volker Weiss, M. Sengupta, and W. Sanford Jan. 1973 104 p refs
(Contract N00019-72-C-0214)
(AD-761217; MTS-VW-1705-F173) Avail: NTIS CSCL 11/6

The relationships between fracture roughness, flow stress and material ductility were studied for the high strength steels, D6AC and 300M, each heat treated to 3 strength levels. In addition to the experimental part of the study which included biaxial ductility test, notch-tensile test and fracture toughness test the theoretical studies, to develop an analytical basis for correlation between fracture toughness and flow properties of solids, were continued. The fracture ductility was found to decrease significantly on going from the uniaxial stress state to the plane strain stress state to the balanced biaxial condition. A strong influence of the surface finish was noted. (Author Modified Abstract) GRA

N73-27464# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
MODIFICATION AND CONTROL OF OXIDE STRUCTURES ON METALS AND ALLOYS, PHASE 3 Final Report, 20 Dec. 1971 - 20 Jan. 1973
Robert C. Svedberg Feb. 1973 199 p refs
(Contract N00019-72-C-0132)
(AD-761215; WANL-M-FR-73-003) Avail: NTIS CSCL 11/6

The rutile structure family for oxide compounds of the type Nb(B)O4 where B = Cr, Al, or Fe have been identified as being the primary oxide phase in the scales formed on oxidation resistant Nb intermetallic compounds and Nb-Ti-Cr-Al, Nb-Fe-Al, Nb-Cr-Al-Co, and Nb-Cr-Al-Ni alloys. Along with this oxide, small amounts of either (B)2O3 where B = Cr, Al, or Fe or a CoAl2O4 spinel in cobalt containing alloys were detected. Oxygen transport rates through Nb2O3-Cr2O3, Nb2O5-TiO2, Nb2O5-ZrO2, and Nb2O5-Al2O3 were also determined using thermogravimetric techniques. Of the oxide compounds evaluated, only oxygen transport through Nb2O5-Cr2O3 was slow enough to warrant its classification as a protective scale. In addition to oxidation rate data, metallographic studies and electron microprobe studies are reported for the Nb intermetallic compounds and alloys. Author

N73-27465# Naval Ship Research and Development Center, Annapolis, Md.
STRESS INTENSITY ON FATIGUE CRACK GROWTH IN A 5456-H117 ALUMINUM ALLOY
H. P. Chu Jun. 1973 44 p refs
(SF54541011)
(AD-760668; NSRDC-28-663) Avail: NTIS CSCL 11/6

Fatigue crack growth data on a 5456-H117 aluminum alloy was obtained by testing compact tension and contoured double cantilever beam specimens. The effect of tensile mean stress on crack growth rate is found to reach a maximum when stress ratio R > or = 0.25. The crack propagation laws are discussed, and two new equations are developed. It is shown that the new equations can represent the entire range of fatigue crack growth rate, versus applied stress intensity for different R values from threshold behavior to unstable fracture. (Author Modified Abstract) GRA

N73-27466# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
ON THE DYNAMICS OF DISLOCATION PINNING DURING DYNAMIC STRAIN AGING
R. E. Reed-Hill 25 Apr. 1973 32 p refs
(Grant DA-ARO(D)-31-124-72-G70)
(AD-760574; AROD-9826:9-MC) Avail: NTIS CSCL 11/6

The recognized phenomena of dynamic strain aging are considered in terms of the dynamics of dislocation pinning by impurity atoms. It is assumed that dislocations become immobilized when their waiting time at a barrier, capable of being overcome with the aid of thermal activation, exceeds the time required to age or immobilize a dislocation. Qualitatively, it would appear that this hypothesis, originally proposed by McCormick to account for the temperature dependence of the initiation of serrations on a stress-strain curve, is basic to all DSA phenomena. Author (GRA)

N73-27467# Martin Marietta Corp., Baltimore, Md.
THE INFLUENCE OF A HEAT TREATMENT ON THE STRESS CORROSION SUSCEPTIBILITY OF A TERNARY Al-5.3 PERCENT Zn-2.5 PERCENT Mg ALLOY Technical Report No. 7
A. J. Sedriks, J. A. Green, and D. L. Novak May 1973 14 p refs Submitted for publication
(Contract N00014-67-C-0496; NR Proj. 031-716)
(AD-761207; MMR-TR-73-07C; TR-7) Avail: NTIS CSCL 11/6

The influence of heat treatment on the stress-corrosion susceptibility of a ternary Al-5.3% Zn-2.5% Mg alloy has been examined in terms of four variables. These variables are the cooling rate from the solution treatment temperature, holding time at room temperature, aging time at a temperature below the G.P. zone solvus and aging time at a temperature above the G.P. zone solvus. Variables which markedly influence the stress-corrosion susceptibility of the Al-Zn-Mg alloys were found to be the cooling rate after solution treatment and the aging time at temperature above the G.P. zone solvus. These results are discussed in terms of variations in the grain boundary microstructure. Author (GRA)

N73-27468# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
A TOPOLOGICAL STUDY OF GRAIN GROWTH Final Report, 1 Jul. 1970 - 15 Oct. 1972

Frederick N. Rhines Mar. 1973 95 p refs
(Grants DA-ARO(D)-31-124-70-G93;
DA-ARO(D)-31-124-71-G149; DA Proj. 200-61102-B-32D)
(AD-760580; ARGD-9208-1-MC) Avail: NTIS CSCL 11/6

The characterization of the topological properties during isothermal grain growth has made it possible, for the first time, to describe grain growth as a topological process and to define its kinetics. Grain growth has been associated with a topological change in which the average topological values per grain in the system approaching limiting values equivalent to those of a tetrakaidecahedron. Experimentally it is found that the product of the total curvature per unit volume and the surface area per unit volume maintains a constant ratio to the grain size constant. Grain growth has been described in this study as taking place in two modes: steady and non-steady state. These relationships have led to the development of a new kinetic equation for grain growth. (Author Modified Abstract) GRA

N73-27469# Martin Marietta Corp., Denver, Colo.
EFFECT OF VACUUM ENVIRONMENT ON MECHANICAL BEHAVIOR Annual Report, Jan. 1971 - Jan. 1973
Irvin R. Kramer Feb. 1973 36 p refs
(Contract F44620-69-C-0065; AF Proj. 9768)
(AD-760529; MCR-73-16; AFOSR-73-0685TR) Avail: NTIS CSCL 11/6

The surface layer stress of titanium alloy (6Al/4V and 5Al/2.5Sn) was measured in methanol-chloride solutions as a function of voltage. The surface layer stress was found to increase markedly as the specimen became more anodic. It is proposed that stress-corrosion cracking is associated with the formation of a surface layer of critical strength to support a pileup of dislocations to cause fracture. The stress corrosion behavior of titanium and aluminum (2014-T6) was determined on specimens with and without the surface layer. A marked increase in the stress corrosion cracking resistance was achieved by eliminating the surface layer. Author (GRA)

N73-27470# Pittsburgh Univ., Pa. Dept. of Metallurgical and Materials Engineering.
STRUCTURE AND SEGREGATION IN CAST ALLOYS
Harold D. Brody 1 May 1973 41 p refs
(Contract N00014-67-A-0402-0003; NR Proj. 031-725)
(AD-761202; MME-HDB573-R1) Avail: NTIS CSCL 11/6

The report consists of two reprints. One reprint is of a technical note that describes a suggested modification to the Nb-C phase diagram to indicate the formation of Nb2C by a peritectic reaction of NbC (s) and Nb (1). The second reprint is of a paper on the impact of solidification research on metals processing. Two major fundamental concepts of the solidification process are reviewed, briefly, and the recent efforts to develop new casting techniques based on these models are mentioned. One major concept describing the conditions to maintain a plane front interface provided the background for growth of metal single crystals and low defect semiconductor materials. Recent efforts have resulted in the growth from the melt of composite materials and transparent ceramics. The second major concept describing the morphology and solute redistribution in the dendritic freezing of alloys has led to a better understanding of microsegregation, macrosegregation, inclusions and grain structure. (Author Modified Abstract) GRA

N73-27471# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
THE COMPUTATION OF THE BULK MODULI OF A SYNTHETIC HYDROCARBON HYDRAULIC FLUID Technical Report, Nov. 1972 - Jan. 1973
F. C. Brooks Apr. 1973 31 p refs
(AF Proj. 7340)
(AD-760776; AFML-TR-73-81) Avail: NTIS CSCL 11/6

The bulk moduli of a synthetic hydrocarbon are calculated and appropriate equations are presented. This is of special interest in studying hydraulic fluids. Methods of determining and predicting bulk moduli are reviewed. A conservative low value of isothermal sedant bulk modulus of the synthetic hydrocarbon candidate was selected from determinations produced with the Klaus apparatus. This selected value served as the primary datum point for calculating isothermal secant and tangent bulk moduli and adiabatic secant and tangent bulk moduli. The results of these calculations are presented in tabular and graphical form for temperatures of 100, 200, 275, 300, 400 and 500 F and pressures between 0 and 5000 psig. Author (GRA)

N73-27472# California Univ., Los Angeles. School of Engineering and Applied Science.
ACOUSTIC EMISSION FROM FERROUS MARTENSITES
Kanji Ono, T. C. Schlotthauer, and T. J. Koppenaal (Philco-Ford Corp., Newport Beach, Calif.) May 1973 21 p refs Presented at the Symp. on Non-Destructive Evaluation (9th), San Antonio, Tex., 25-27 Apr. 1973
(Contract N00014-69-A-0200-4031; NR Proj. 386-700)
(AD-761220; UCLA-ENG-7334) Avail: NTIS CSCL 11/6

Acoustic emission during martensitic transformation of two Fe-Ni-C alloys (31.4 Ni-0.03 C and 22 Ni-0.44 C) has been investigated as a function of their thermo-mechanical history. Starting conditions examined include: a) as annealed equiaxed austenite (gamma), b) 20, 50 and 80% rolling of (a) at room temperature, c) transformed to martensite (alpha prime) and then rapidly reverted to gamma, d) reverted gamma from 20, 50 and 80% deformed alpha prime, e) reverted gamma after 5 thermal cyclings with or without prior deformation. Acoustic emission total counts were monitored as a function of temperature (Author Modified Abstract) GRA

N73-27473# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.
IMPROVEMENT OF TITANIUM ALLOY INGOT CONSOLIDATION Final Technical Report, May 1970 - Nov. 1971
Floyd W. Wood and Raymond L. Carpenter May 1972 108 p refs
(Contract F33615-69-M-5010)
(AD-748261; AFML-TR-72-46) Avail: NTIS HC $3.00 CSCL 11/6

An attempt was made to develop a manufacturing method for the elimination of nitride inclusions from titanium alloys as they are melted. The trial scheme involved skull casting as the first of two melting stages. Ten-inch-diameter ingots of Ti6Al 4V were produced with artificial nitride defects added. The ingots were converted to one-inch-thick plates for evaluation. Preliminary results of examining rolled plates revealed that the proposed manufacturing method failed to eliminate the synthetic nitride-induced flaws. Also, the degree to which it may have helped is uncertain because of the appearance of extraneous types of defects and difficulties in finding and identifying defects. Metallographic specimens were prepared from all major defect areas. The defects were differentiated according to microstructure and their composition was determined by microprobe analyses.
Author (GRA)

N73-27494 Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).
EUTECTIC ALLOYS WITH UNI-DIRECTIONAL SOLIDIFICATION: STUDY ON THEIR USE FOR TURBINE BLADES
H. Huff and W. Betz *In* AGARD Impact of Composite Mater. on Aerospace Vehicles and Propulsion Systems May 1973 6 p refs (For availability see N73-27474 18-18)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N73-27474# Advisory Group for Aerospace Research and Development, Paris (France).
IMPACT OF COMPOSITE MATERIALS ON AEROSPACE VEHICLES AND PROPULSION SYSTEMS
May 1973 288 p refs In ENGLISH and partly in FRENCH Presented at Joint Symp. of the AGARD Structures and Mater. Panel, and Propulsion and Energetics Panel, Toulouse, 20-22 Sep. 1972
(AGARD-CP-112) Avail: NTIS HC $16.50

The proceedings of a conference on the use of composite

materials in the construction of aerospace vehicles and propulsion systems are presented. The subjects discussed include the following: (1) mechanical properties of high performance plastic composites, (2) design concepts using composites in airframes, (3) design and manufacturing aspects of composite materials with organic matrices, (4) application of advanced fibrous composites to aeronautical gas turbine engines, and (5) failure analysis of fiber reinforced composite motor case.

N73-27475 Air Force Materials Lab., Wright-Patterson AFB, Ohio. Nonmetallic Materials Div.

MECHANICAL PROPERTIES OF HIGH PERFORMANCE PLASTIC COMPOSITES

Theodore J. Reinhart, Jr. *In* AGARD Impact of Composite Mater. on Aerospace Vehicles and Propulsion Systems May 1973 27 p refs (For availability see N73-27474 18-18)

Data and information are presented on high-strength, high-modulus reinforcing fibers and organic resin composites fabricated from these fibers. Glass, boron, graphite, various metallic, PRD-49-III and silicon carbide fiber and composite properties are discussed. Combined fiber or hybrid composites containing boron and S-glass, and beryllium fibers and S-glass are discussed. The properties of the various forms of asbestos reinforcements are presented along with the mechanical properties of several asbestos reinforced epoxy-resin composites. Fatigue, creep and stress rupture data are presented where data on similar composite constructions could be found in the literature. Author

N73-27476 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Bauweisen- und Konstruktionsforschung.

FIBER REINFORCED MATERIALS FOR APPLICATION IN THE COLD PART OF TURBINE ENGINES

Gerhard Grueninger and Richard Kochendoerfer *In* AGARD Impact of Composite Mater. on Aerospace Vehicles and Propulsion Systems May 1973 13 p refs (For availability see N73-27474 18-18)

The strength to density ratio property of fiber reinforced materials with plastic and metallic matrix is discussed. The properties of fibrous materials used in structures which are submitted to uniaxial loads are analyzed. The use of composite materials for blades and discs of turbine engines for operation at elevated temperatures is analyzed. Author

N73-27477 Hawker Siddeley Aviation, Ltd., Woodford (England).

CARBON FIBRE COMPOSITES: PROMISES AND PROBLEMS

W. G. Heath *In* AGARD Impact of Composite Mater. on Aerospace Vehicles and Propulsion Systems May 1973 11 p refs (For availability see N73-27474 18-18)

Structures of carbon fiber composite show great promise in reduction of weight and freedom from fatigue and corrosion. They also permit the designer to tailor the material to match the applied loading. There are, on the other hand, serious problems to be overcome: the high cost of the material,, its brittle nature, its susceptibility to erosion and its lack of ro bustness, the variability between apparently identical components, and the difficuity of making joints between sub-assemblies. This paper examines the promises and problems in turn; it shows how the promising features might be exploited more fully and seeks solutions to the problems. Author

N73-27478 Naples Univ. (Italy).

PRODUCTION OF FIBROUS METAL COMPOSITES BY POWDER ROLLING

I. Crivelli Visconti, P. Jauch (Aeritalia, Naples), and C. Voto (Aeritalia, Naples) *In* AGARD Impact of Composite Mater. on Aerospace Vehicles and Propulsion Systems May 1973 23 p refs (For availability see N73-27474 18-18)

The fundamental aspects of powder rolling are considered regarding both the production of continuous strips starting from metal powder and the production of fibrous metal composites obtained by contemporary rolling of powder with strong reinforcing wires. The method can be applied to a large number of matrix-fibers systems of aeronautical interest. After a description of the influence of each parameter regulating the physical properties of the green strip, like roll gap, feeding system, type and size of powder, roll diameter, number of fibers, some of theoretical and experimental properties of systems of practical interest are reported. From the results obtained during the entire work on the described method the actual potential and advantages of this method of metal composites fabrication is discussed in relation to other similar methods and a few examples of possible applications are given. Author

N73-27479 British Aircraft Corp., Preston (England). Military Aircraft Div.

DESIGN CONCEPTS FOR THE USE OF COMPOSITES IN AIRFRAMES

I. C. Taig *In* AGARD Impact of Composite Mater. on Aerospace Vehicles and Propulsion Systems May 1973 18 p refs (For availability see N73-27474 18-18)

A philosophy for design of filamentary composite components, emphasising integrity and cost-effectiveness, is outlined. This involves intensive development of a limited number of basic structural concepts. Several such concepts, applicable to airframe structures, are reviewed, starting with a simplified assessment of their structural efficiency (measured in terms of mass saving) and including a brief discussion of features relating to integrity and fabrication. The review includes composite reinforcement of metal structures, solid rods, tubes and beams, sandwich skin panels and sandwich box structures, stiffened skins and wound tubes and lattices. Particular attention is given to attachments and load introduction and a brief section deals with bonded and mechanical joints. The paper concludes with illustrations of structures embodying some of the concepts described. Author

N73-27480 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.

DESIGN AND FAILURE CRITERIA OF ADVANCED COMPOSITE PRIMARY STRUCTURE

Larry G. Kelly *In* AGARD Impact of Composite Mater. on Aerospace Vehicles and Propulsion systems May 1973 8 p (For availability see N73-27474 18-18)

The design, fabrication, and flight test of a boron/epoxy F-111 stabilizer are discussed. The applicability of this composite material to airframe construction and the ability to achieve significant weight savings are reported. The material allowables and design philosophy utilized in the evolution of this structure are employed as an example of an approach to establishing logical failure criteria from which efficient designs can be developed with continuous aligned high modulus-high strength composite materials. One of the outstanding features of filamentary composite materials is their directional properties which provides the ability through crossplying of lamina to tailor a structure which meets specific loads and/or stiffness requirements with a minimum amount to material and weight. Thus a more efficient and reliable method of establishing design allowables for all laminates of interest was developed. The approach selected was to experimentally determine the stress-strain response to simple unidirectional laminae at the required design temperature and with the aid of a mathematical model establish a failure envelope to serve as the designers tool for selection of a suitable laminate thickness and ply orientation for a given set of load conditions. Author

N73-27481 Stuttgart Univ. (West Germany).

PRESENT AND FUTURE POSSIBILITIES OF HIGH STRENGTH AND STIFFNESS-TO-WEIGHT RATIO COMPOSITES IN PRIMARY STRUCTURES

Ulrich Huetter *In* AGARD Impact of Composite Mater. on Aerospace Vehicles and Propulsion Systems May 1973 14 p refs Prepared in cooperation with DFVLR, Stuttgart (For availability see N73-27474 18-18)

The application of composite materials to primary aircraft and spacecraft structures is discussed. Some of the limitations which affect the use of the composite materials for certain purposes are described. The mechanical and physical properties of shell structures are reported. A hypothesis for composite material failure is developed. Charts, graphs, and diagrams are included to clarify the theoretical concepts. Author

N73-27482 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

APPLICATION OF COMPOSITE MATERIALS FOR AEROSPACE STRUCTURES

F. Och and W. Jonda *In* AGARD Impact of Composite Mater. on Aerospace Vehicles and Propulsion Systems May 1973 10 p refs (For availability see N73-27474 18-18)

The use of reinforced composite materials for aerospace structures is discussed. Component developments for the application of various composites, such as glass, carbon, and PRD, as well as combinations of glass and carbon are reviewed. An example of an all-glass composite used in a third stage of a rocket launcher is presented. The application of all-carbon composites for helicopter rotor blades is reported. The mechanical and physical properties of PRD-49 organic fiber are analyzed. Author

N73-27483 Westland Helicopters Ltd., Hayes (England).

USE OF COMPOSITES IN HELICOPTERS: ADVANTAGES AND DISADVANTAGES

H. F. Winny *In* AGARD Impact of Composite Mater. on Aerospace Vehicles and Propulsion Systems May 1973 9 p refs (For availability see N73-27474 18-18)

A survey is given of the use of glass and carbon fiber composite materials for helicopter structures. It is reported that glass reinforced plastics should be used on rotorheads of the semi-rigid types and on rotor blades where fatigue strength and low stiffness and density are required to save weight. Carbon fiber reinforced plastics are recommended for the main helicopter structures. A summary of the strength and stiffness properties of both types of composites is presented. Methods of overall fabrication for cost effective materials are proposed. Author

N73-27484 Societe Nationale Industrielle Aerospatiale, Courbevoie (France). Dept. Structures Nouvelles.

COMPOSITES IN ENGINE STRUCTURES AND THEIR ADAPTATION TO AERONAUTICAL NEEDS [LES COMPOSITES DANS LES STRUCTURES D'ENGINS ET LEUR ADAPTATION AUX BESOINS AERONAUTIQUES]

G. Jube *In* AGARD Impact of Composite Mater. on Aerospace Vehicles and Propulsion Systems May 1973 10 p In FRENCH (For availability see N73-27474 18-18)

The use of highly rigid composite materials in aircraft structures, particularly engine structures is examined. A detailed review was made of the use of reinforced boron and carbon filaments. A comparison was also made of the fatigue life of the two materials. Transl. by E.H.W.

N73-27485* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

APPLICATION OF COMPOSITES TO THE SELECTIVE REINFORCEMENT OF METALLIC AEROSPACE STRUCTURES

W. A. Brooks, Jr., E. E. Mathauser, and R. A. Pride *In* AGARD Impact of Composite Mater. on Aerospace Vehicles and Propulsion Systems May 1973 15 p refs (For availability see N73-27474 18-18)

CSCL 11D

The use of composite materials to selectively reinforce metallic structures provides a low-cost way to reduce weight and a means of minimizing the risks usually associated with the introduction of new materials. An overview is presented of the NASA Langley Research Center programs to identify the advantages and to develop the potential of the selective reinforcement approach to the use of composites. These programs have shown that selective reinforcement provides excellent strength and stiffness improvements to metallic structures. Significant weight savings can be obtained in a cost effective manner. Flight service programs which have been initiated to validate further the merits of selective reinforcement are described. Author

N73-27486 Technische Universitaet, Brunswick (West Germany). Inst. fuer Flugzeugbau und Leichtbau.

EXPERIENCE WITH COMPOSITES AS OBTAINED FROM GLIDERS

W. F. Thielemann *In* AGARD Impact of Composite Mater. on Aerospace Vehicles and Propulsion Systems May 1973 7 p (For availability see N73-27474 18-18)

A survey is given of the design and manufacture of gliders using glass fiber and carbon fiber reinforced plastic composites for primary structures. The two main advantages cited are: (1) the possibility of getting very smooth surfaces of high aerodynamic quality and (2) the possibility of reducing the fabrication costs by producing large integral structures instead of assembling many prefabricated metallic structural details. The design problems, structural problems, and performance test data for reinforced plastic construction are reported. Author

N73-27487 Army Air Mobility Research and Development Lab., Fort Eustis, Va. Structures Div.

ADVANCES IN BALLISTICALLY TOLERANT FLIGHT CONTROLS c02

I. E. Figge, Sr. *In* AGARD Impact of Composite Mater. on Aerospace Vehicles and Propulsion Systems May 1973 8 p refs (For availability see N73-27474 18-18)

Combat data indicate that helicopter flight control components are exceptionally vulnerable to catastrophic failure upon ballistic impact. The ballistic tolerance approach, which is to design the critical components to function after ballistic penetration, offers a solution to reduce vulnerability. Studies have shown that this approach can virtually eliminate catastrophic failure while achieving substantial weight saving and reduced production costs. Limited data indicate the approach is also adaptable to flight control bearings and attachments. Venting was found to reduce the damage on the exit side of sandwich structures and preslotting was found to prevent delamination of the exit face in the area of impact. Author

N73-27488 Royal Aircraft Establishment, Farnborough (England). Structures Dept.

INSTABILITY OF LAMINATED COMPOSITE PLATES

G. Z. Harris *In* AGARD Impact of Composite Mater. on Aerospace Vehicles and Propulsion Systems May 1973 19 p refs (For availability see N73-27474 18-18)

The response of general laminated plates to applied loading exhibits a coupling between bending and extensional modes of deformation. Such a laminate will, for example, undergo a bending response when load is applied in the plane of the laminate. Such coupling may be significant when shear or compressive loads are applied in-plane, since the additional deformation modes may reduce the buckling load or affect the post-buckling stiffness of the laminate. The present paper considers the stiffness immediately after buckling of two types of panel which undergo bifurcational buckling. The first class of panel considered is one of angle-ply type. A solution is derived for the initial buckling of a rectangular panel to which is applied a constant end displacement. The pre-buckling response is one which exhibits no out of plane displacements, although the initial buckling load is affected by the existence of out-of-plane coupling. The second class of panel is of cross-ply type, the buckling loads being derived for a long panel having a constant strain edge member and subjected to end load. Author

N73-27489 Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost.

DESIGN AND MANUFACTURING ASPECTS OF COMPOSITE MATERIALS WITH ORGANIC MATRICES FOR APPLICATION AT HIGH TEMPERATURES

J. J. Cools *In* AGARD Impact of Composite Mater. on Aerospace Vehicles and Propulsion Systems May 1973 15 p refs (For availability see N73-27474 18-18)

Some design and manufacturing aspects are presented of the mixed-structure concept which was developed for application in aerospace structures subjected to high temperatures. In this concept a HM-composite material with an organic matrix is laminated between metallic faces to combine simultaneously the favorable features of both types of materials. The HM-composite material is the main load carrying component. The metallic faces protect the organic matrix against oxidation by air at high temperatures, provide an electrically conductive surface of the structure and contribute to stabilization against buckling. The mixed-structure concept can also be applied to aerospace structures, subjected to normal operating temperatures. Author

N73-27490 National Gas Turbine Establishment, Pyestock (England).

A LIMITED REVIEW OF THE APPLICATION OF ADVANCED FIBROUS COMPOSITES TO AERO GAS TURBINE EN-

GINES
A. W. H. Morris *In* AGARD Impact of Composite Mater. on Aerospace Vehicles and Propulsion Systems May 1973 16 p refs (For availability see N73-27474 18-18)
CSCL 11D

A review of fiber reinforced composite material relevant to aero gas turbine engine application is presented for systems both commercially available and projected. Emphasis has been placed on those mechanical property requirements and fabrication problems which are peculiar to gas stream components. Although high strength and high elastic modulus composites are available in organic and inorganic matrices for low temperature application, these materials exhibit extremely poor impact and erosion characteristics which may limit use where foreign object damage is prevalent. Several engineering solutions to the problem are discussed. The application of composites in the high temperature turbine stage has difficulties such as fiber stability and thermal fatigue and is considered to be very impractical. The development of directionally solidified eutectics, which can loosely be described as composites, offers more encouragement as the next generation turbine material. Author

N73-27491* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MATERIAL AND STRUCTURAL STUDIES OF METAL AND POLYMER MATRIX COMPOSITES
Robert A. Signorelli, Tito T. Serafini, and Robert H. Johns *In* AGARD Impact of Composite Mater. on Aerospace Vehicles and Propulsion Systems May 1973 16 p refs (For availability see N73-27474 18-18)

Fiber-reinforced composites and design analysis methods for these materials are being developed because of the vast potential of composites for decreasing weight and/or increasing use temperature capability in aerospace systems. These composites have potential for use in airbreathing engine components as well as aeronautical and space vehicle structures. Refractory wire-superalloy composites for use up to 2200 F or more and metal-matrix composites for lower temperature applications such as aerospace structures and turbojet fan and compressor blades are under investigation and are discussed. The development of a number of resin systems, including the polyimides and polyphenylquinoxalines, is described and their potential for use at temperatures approaching 315 C (600 F) is indicated. Various molecular modifications that improve processability and/or increase thermal and oxidative resistance of the resins are also described. Structural analysis methods are discussed for determining the stresses and deformations in complex composite systems. Consideration is also given to residual stresses resulting from the curing process and to the foreign object damage problem in fan blade applications. Author

N73-27492 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ELABORATION OF REFRACTORY COMPOSITE MATERIALS BY DIRECTIONAL SOLIDIFICATION [ELABORATION DE MATERIAUX COMPOSITES REFRACTAIRES PAR SOLIDIFICATION ORIENTEE]
Maurice ElGammal *In* AGARD Impact of Composite Mater. on Aerospace Vehicles and Propulsion Systems May 1973 10 p refs In FRENCH; ENGLISH summary (For availability see N73-27474 18-18)

The principles of directional solidification for producing lamellar and fibrous composite materials from eutectic alloys are discussed. Some pseudo-binary eutectics and more complex alloys are compared for high mechanical strength at elevated temperatures. The properties of these materials are outlined in order to determine the use for turbine blades and vanes. Problems involved in the application of the composite materials are presented. Author

N73-27493 General Electric Co., Cincinnati, Ohio.
DIRECTIONALLY SOLIDIFIED EUTECTICS IN GAS TURBINE DESIGN
L. P. Jahnke, H. J. Brands, and G. D. Oxx, Jr. *In* AGARD Impact of Composite Mater. on Aerospace Vehicles and Propulsion Systems May 1973 9 p refs (For availability see N73-27474 18-18)

Composite structures consisting of high strength fibers or plates in ductile matrices with outstanding high temperature properties are achievable in directionally solidified eutectics. This new class of materials represents a major innovation in gas turbine blade technology. The advantages and limitations of the two more promising eutectics systems and the relationship of these properties to turbine blade design is discussed. Innovations in design and further property improvements will be required to successfully exploit these materials in engine hardware. It is concluded that the payoff offered by this technology fully justifies a major investment of resources to achieve a practical system. Author

N73-27494 Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).
EUTECTIC ALLOYS WITH UNI-DIRECTIONAL SOLIDIFICATION: STUDY ON THEIR USE FOR TURBINE BLADES
c17
H. Huff and W. Betz *In* AGARD Impact of Composite Mater. on Aerospace Vehicles and Propulsion Systems May 1973 6 p refs (For availability see N73-27474 18-18)

The principle of directional solidification of eutectic alloys is briefly shown and the influence of temperature gradient, solidification rate and impurities is described. Using a list of the most important demands on turbine blade materials the merits and demerits of directionally solidified eutectics for this purpose are discussed. It seems that there are good chances for utilizing this compound material for gas turbines. There will be, however, a lot of further investigations necessary especially with respect to casting technology. Author

N73-27495 Rolls-Royce, Ltd., Bristol (England). Engine Div.
POTENTIAL USE OF COMPOSITE MATERIALS FOR GAS TURBINE STATIC STRUCTURES
J. W. Sharp and L. Battezzato (Fiat S.P.A.) *In* AGARD Impact of Composite Mater. on Aerospace Vehicles and Propulsion Systems May 1973 14 p refs (For availability see N73-27474 18-18)

The applications of composite materials on a number of static gas turbine components and assessment of these components have shown that they can be made lighter than their metal design equivalent. Cost savings in some cases could also be expected although some improved manufacturing techniques are necessary. The materials considered are primarily glass and carbon fiber reinforced structures with a working temperature up to 250 C. Experience with such composite structures are reviewed including failures and successes. Author

N73-27496 Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Corbeil (France).
APPLICATION OF THE BASE COMPOSITES OF CARBON FIBERS AND BORON WIRE TO COMPRESSOR BLADES [APPLICATION DE COMPOSITES A BASE DE FIBRES OF CARBONE ET DE FILS DE BORE AUX AUBES DE COMPRESSEUR]
P. Lescop and R. Chevalier *In* AGARD Impact of Composite Mater. on Aerospace Vehicles and Propulsion Systems May 1973 8 p In FRENCH (For availability see N73-27474 18-18)

A critical summary was made of the fabrication of compressor blades from metallic composites. The mechanical resistance, vibration characteristics, fatigue, and erosion properties of carbon epoxy, boron epoxy, boron-aluminum composite blades were examined. Performance tests results are given in tables.
Transl. by E.H.W.

N73-27497 Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
FATIGUE TOLORANCE OF DAMAGED METAL COMPOSITE BLADING
T. J. Norbut *In* AGARD Impact of Composite Mater. on Aerospace Vehicles and Propulsion Systems May 1973 10 p refs (For availability see N73-27474 18-18)

The successful exploitation of the lightweight high specific strength and modulus features of metal matrix composite systems in turbine engine blading rests heavily on the realistic assessment of the materials inherent tolerance to sustain damage from foreign objects ingested into the engine. The spectrum of foreign object debris typically contained in military and commercial engine specifications is summarized to obtain a perspective of the debris

characteristics a turbine engine is expected to ingest and reliably tolerate. The scope of these specifications served as the basis for the development of a damage simulation technique for a specific class of foreign object debris. 403 stainless steel and Ti 6Al-4V blades damaged with this technique were compared to typical field damage blades and found to correlate favorably. The technique was subsequently utilized to damage representative Boron/Aluminum airfoil specimens for evaluation of fatigue strength degradation effects. It was concluded that Boron/Aluminum possessed a considerably lower notch sensitivity in high cycle fatigue when compared to the notched fatigue characteristics of homogeneous blade materials. Author

N73-27498 Pratt and Whitney Aircraft, East Hartford, Conn.
BORON-POLYIMIDE REINFORCED TITANIUM FAN DISKS
Hans Stargardter and Karl Jakobsen *In* AGARD Impact of Composite Mater. on Aerospace Vehicles and Propulsion Systems May 1973 10 p (For availability see N73-27474 18-18)

The design, fabrication, and testing of boron-polyimide reinforced titanium fan disks having a temperature capability of 600 F are described. The high modulus and low density of this material allow for a redesign of the fan disk with a reduction in weight of 36% compared to the conventional design. Processing techniques involving filament winding and resin curing were developed on 10 inch diameter hoops. Two fullscale disks were fabricated and evaluated through spin testing to 600 F. Author

N73-27499 Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Villaroche (France). Dept. Resistance des Materiaux.
STUDY OF DISK BINDING OF COMPRESSORS BY BASE COMPOSITES OF BORON WIRE [ETUDE DU FRETTAGE DES DISQUES DE COMPRESSEUR PAR DES COMPOSITES A BASE DE FIL DE BORE]
Claude Stoltz *In* AGARD Impact of Composite Mater. on Aerospace Vehicles and Propulsion Systems May 1973 8 p In FRENCH (For availability see N73-27474 18-18)

A theoretical study was made of the general principles of binding compressor disks with boron composites. Data cover possible weight reductions and peripheral speed augmentation. Crack and endurance tests are also made. The results are compared with predictions. Transl. by E.H.W.

N73-27500 Army Missile Command, Redstone Arsenal, Ala.
FAILURE ANALYSIS OF A FIBER REINFORCED COMPOSITE MOTOR CASE USING DISTORTIONAL ENERGY AND MAXIMUM STRAIN THEORIES OF FAILURE
Richard J. Thompson, John W. Sofferis, and Charles M. Eldridge *In* AGARD Impact of Composite Mater. on Aerospace Vehicles and Propulsion Systems May 1973 3 p refs (For availability see N73-27474 18-18)

A method of determining the failure condition of a fiber reinforced composite structure is extended for application to an actual design and analysis problem. The original method uses the distortional energy and maximum strain theories of failure. A finite element stress analysis program was modified for application to fiber composites. This work extends the failure program to include helical tubes. The method of calculation of wrap angle is altered after first stage yielding as pressure increments are increased. Provision was made to automatically update the displacement field. After each loading increment, the displacement field is calculated and the new values are added to the old ones. Author

N73-27501*# Little (Arthur D.), Inc., Cambridge, Mass.
FLAME RETARDANT ELASTOMERIC COMPOSITIONS Patent Application
John T. Howarth, Arthur A. Massucco, Kenneth R. Sidman, and Suresh G. Sheth, inventors (to NASA) Filed 28 Jun. 1973 46 p
(Contract NAS9-10424)
(NASA-Case-MSC-14331-1; US-Patent-Appl-SN-374421) Avail: NTIS HC $4.50 CSCL 11D

The development of flame retardant elastomeric compositions is discussed. The materials are used in fabricating flight clothing used during extravehicular activities. The process for producing the material is described. The novelty of the development is the use of urethane with retardant reacted directly into the polymer chain. NASA

N73-27502*# United Aircraft Corp., East Hartford, Conn. Research Labs.
DEVELOPMENT OF LARGE DIAMETER CARBON MONOFILAMENT Contractor Report, Jun. 1972 - Jan. 1973
B. Jacob and R. D. Neltri Jan. 1973 40 p refs
(Contract NAS3-15842)
(NASA-CR-121229) Avail: NTIS HC $4.00 CSCL 11E

A process for preparing large diameter carbon-boron monofilament was developed. The process involves chemical vapor depositing a carbon-boron alloy monofilament from a BCl3, CH4, and H2 gas mixture onto a carbon substrate. Amorphous alloys were formed when gaseous mixtures containing greater than 20 percent methane (80 percent BCl3) were used. The longest uninterrupted lengths of carbon-boron monofilament were produced using a CH4/BCl3 gas ratio of 2.34. It was found that the properties of the carbon-boron alloy monofilament improved when the carbon substrate was precleaned in chlorine. The highest strength monofilament was attained when a CH4/BCl3 gas volume ratio of 0.44 was 28 million N/sq cm (40 million psi). While the highest strengths were attained in this run, the 0.44 gas ratio and other CH4/BCl3 ratios less than 2.34 would not yield long runs. Runs using these ratios were usually terminated because of a break in the monofilament within the reactor. It is felt better process control could probably be achieved by varying the amount of hydrogen; the BCl3/H2 ratio was kept constant in these studies. Author

N73-27503# Explosives Research and Development Establishment, Waltham Abbey (England).
THE EFFECT OF HIGH TEMPERATURE AND OIL IMMERSION ON RUBBERS
B. E. Brokenbrow and A. L. Stokoe Mar. 1972 40 p refs
(AD-760066; ERDE-TR-93; BR34930) Avail: NTIS CSCL 11/10

The physical properties of a number of rubber vulcanisates have been measured at 22, 100 and 150C before and after ageing in a non-aromatic oil, an aromatic oil and dry air at 100 and 150C. The results show that the immediate effect of raising the operating temperature in air to 100 and 150C seriously impairs the tensile properties of all the rubbers and the effect of oil in comparison is initially only marginal. The rubbers as compounded for this investigation can be divided into 4 categories with regard to resistance to ageing in oil and air. Author (GRA)

N73-27504# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
MICROMECHANICS FAILURE CRITERIA FOR COMPOSITES Final Summary Report, 3 Apr. 1972 - 7 May 1973
Longin B. Greezczuk 7 May 1973 153 p refs
(Contract N00019-72-C-0221)
(AD-761221; MDC-G4701) Avail: NTIS CSCL 11/4

Theoretical and experimental studies are presented of the micromechanics failure criteria for the transverse tensile and shear strengths of composites. Parameters accounted for in the failure theories include: fiber properties, matrix properties, fiber content, void content, volume fraction of ineffective fibers, internal triaxial stresses due to fibers and voids, and the interaction of stresses from fibers and voids. Equations are developed for predicting the influence of voids on elastic properties and internal stresses in solids containing voids. The voids are assumed to be cylindrical and arranged in a square array. Pertinent expressions are given for the Young's moduli, shear moduli, and Poisson's ratios of solids with voids. Approximate expressions are also presented for the internal stresses in solids containing voids. (Author Modified Abstract) GRA

N73-27505# Honeywell, Inc., Minneapolis, Minn. Systems and Research Div.
SOLAR ABSORBER COATING STUDY
Ronald E. Peterson and James W. Ramsey May 1973 72 p refs
(Contract F33615-72-C-1689; AF Proj. 7360)
(AD-760577; HONEYWELL-2810-3011; AFML-TR-73-80) Avail: NTIS CSCL 11/3

The study has examined solar absorber coatings intended for use on a solar heat source system to provide thermal energy to drive spaceborne Vuilleumier cycle cryogenic refrigerators. The tests have evaluated potential coating durability for an expected 3 to 5 years in space at an operating temperature of 1600F. Two coatings, Al2O3-Mo-Al2O3 (AMA) and Al2O3-Pt-Al2O3 (APA) were tested on four substrates: stainless steel, Inconel, TZM and Cb-1 percent Zr. On stainless steel and Inconel substrates both coatings were found to withstand one hour vacuum bakes up to approximately 1700F. Auger analysis indicated components of the Inconel or SS had diffused completely through the coating at higher temperatures. (Author Modified Abstract) GRA

N73-27506# Norton Co., Worcester, Mass. Industrial Ceramics Div.
CERAMIC MATERIALS IN ROLLING CONTACT BEARINGS Final Report, 3 Jan. 1972 - 3 Feb. 1973
William M. Wheildon, H. Robert Baumgartner, David V. Sundberg, and Maurice L. Torti 3 Feb. 1973 93 p refs
(Contract N00019-72-C-0299)
(AD-761200) Avail: NTIS CSCL 11/2

The contract for investigation of ceramic materials in rolling contact bearings, was carried out with high strength silicon nitride, silicon carbide and aluminum oxide. Screening rolling contact fatigue testing on silicon nitride with conventional lubricants showed excellent life, greater than M50 steel, at comparable load. The friction and wear properties were determined for silicon nitride, silicon carbide and steel. The coefficient of friction and wear rates are nearly the same for steel-steel and steel-silicon nitride combinations. (Author Modified Abstract) GRA

N73-27507# Lockheed Propulsion Co., Redlands, Calif.
HTPB POLYMER IMPROVEMENT Final Report, 15 Dec. 1971 - 31 Jan. 1973
W. E. Baumgartner and G. E. Myers Edwards AFB, Calif. AFRPL Mar. 1973 70 p
(Contract F04611-72-C-0038)
(AD-760579; LPC-625-F; AFRPL-TR-73-8) Avail: NTIS CSCL 11/9

The ARCO Chemical Company has developed a free radical process for producing a hydroxyl terminated polybutadiene (HTPB) polymer. The product, which is being marketed under the tradename poly bd resin, is attractive costwise for solid propellant binder application. The program was to determine whether modifications of the existing process would produce material superior to the commercial product in high performance propellant application. To explore this, a series of experimental polymers representative of the range of process variables that can be enacted were prepared. These HTPB prepolymers ranged in molecular weight, Mn, from 1800 to 6000, and in functionality, fw, from 2 to 2.7. (Author Modified Abstract) GRA

N73-27508# Sanders Associates, Inc., Nashua, N.H. Electro-Optics Div.
ARC LAMP COATING DEVELOPMENT PROGRAM Final Report, 1 Sep. 1972 - 28 Feb. 1973
John R. Kreick and G. Anderson 28 Apr. 1973 82 p refs
(Contract N00014-73-C-0085)
(AD-761204) Avail: NTIS CSCL 11/3

The work accomplished under this program entailed the evaluation of coatings to provide protection from oxidation for Niobium as used with Alkali Metal Arc Lamps. Fourteen coatings were evaluated by coating lamp replica samples and subjecting the samples to a life test. The conditions of the life test represented typical temperatures and thermal cycling conditions for air operating lamps. The results of the testing showed that one coating provided protection for 100 hours at which time the test was terminated. Several other coatings provided protection for 50 hours before failure. All coatings were compatible with present fabrication techniques for Alkali Metal Arc Lamps. Author (GRA)

N73-27509# Picatinny Arsenal, Dover, N.J. Materials Engineering Div.
THE LOCATION OF ADHESIVE BOND FAILURE BY USING RADIOACTIVE TRACERS
C. A. L. Westerdahl and J. R. Hall Mar. 1973 35 p refs
(AD-761073; PA-TR-4498) Avail: NTIS CSCL 11/1

The absorption of several radioactive ions on aluminum surfaces during the surface treatment of coupons for adhesive bonding was studied. These were (51)Cr(7) in the FPL chromic-sulfuric acid etch, and (45)Ca(-2), (54)Mn(-2), (50)Fe(-3)ions in the rinse water. Calcium was the most strongly adsorbed ion; manganous and ferric ions showed less than 1% monolayer coverage. (14)CH3 -Bisphenol. A diglycidyl ether was synthesized from labeled bisphenol A and epichlorohydrin, and used in a room temperature curing adhesive to bond 2024T-3 aluminum lap shear specimens. Autoradiography was performed on coupons with very thin layers of adhesive remaining after tensile failure of the bonded specimens. Author (GRA)

N73-27510# Pfizer, Inc., Easton, Pa.
RESEARCH STUDY IN EVALUATION OF GRAPHITE RIBBON COMPOSITES Final Technical Report
Robert W. Froberg Dec. 1972 100 p refs
(Contract DAAG46-72-C-0071; DA Proj. 1W9-62113-A-661)
(AD-761124; AMMRC-CTR-72-28) Avail: NTIS CSCL 11/4

Thin graphite film, rather than graphite filaments, may be the preferred reinforcement for some advanced composite applications because the 0.0003-inch thick film is more readily adapted to the fabrication of thin planar isotropic laminates in the range of 0.0003-inch to 0.020-inch thick. The report covers the research program on the preparation and testing of pyrolytic graphite film polymeric matrix laminates. The films that were used ranged between 0.0001-inch 0.0004-inch in thickness with the nominal value about 0.0003-inch. The tensile strength of the material ranged between 30 ksi and 110 ksi and the tensile modulus between 3 million psi and 13 million psi, with the average about 60 ksi and 7 million psi respectively. The average density was about 1.6 gm/cc. (Author Modified Abstract) GRA

N73-27511# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE INFLUENCE OF HEAT TREATMENT ON THE FATIGUE STRENGTH OF SAMPLES MADE FROM ORGANIC GLASS
V. G. Krivulya 10 May 1973 11 p refs Transl. into ENGLISH from Eksp. Nadezhnost, Rachestvo i Svoistva Samoletnogo Organ. Stekla (USSR), no. 177, 1971 p 165-169
(AD-760961; FTD-HT-23-439-73) Avail: NTIS CSCL 11/9

The Russian research describes the hardening of organic polymer glasses of the brands SO-120 and SO-95 which increases the endurance limit by 57%. GRA

N73-27512# TRW Systems Group, Redondo Beach, Calif.
HOLOGRAPHIC CHARACTERIZATION OF CERAMICS. PART 3: MEASUREMENT OF SURFACE ROUGHNESS Final Report, 20 Jan. 1972 - 20 Feb. 1973
Terry V. Roszhart and Jack R. Bohn 20 Mar. 1973 77 p refs
(Contract N00019-72-C-0126)
(AD-761198) Avail: NTIS CSCL 11/2

The measurement of rough material surfaces using coherent laser light is investigated. A stochastic analysis relating the statistical parameters of random surfaces to the statistical parameters of a coherent diffraction pattern scattered by the surface is presented. The relationship of the standard deviation sigma (z) and the autocorrelation distance T(z) to the average bi-directional light intensity is shown as is the probability density function of the individual coherent intensities. The experimental verification of theory is then demonstrated and the optical characterization of surfaces with known properties is performed. The application of these techniques to the characterization of ceramic surfaces and processes is discussed. Author (GRA)

N73-27513# Texas A&M Univ., College Station. Mechanics and Materials Research Center.
A THEORY OF CRACK GROWTH IN VISCOELASTIC MEDIA
R. A. Schapery Mar. 1973 131 p refs
(Contract N00014-68-A-0308-0003; NR Proj. 064-520)
(AD-759379; MM2764-73-1; TR-2) Avail: NTIS CSCL 11/4

A theory is developed for predicting the time-dependent size and shape of cracks in linearly viscoelastic, isotropic media, and its validity is demonstrated by applying the theory to crack growth

and failure of unfilled and particulate-filled polymers. A simple equation is derived for predicting instantaneous crack tip velocity in terms of the opening-mode stress intensity factor. A further analysis is made to predict the time at which a crack starts to grow, and then some explicit solutions are given for this so-called fracture initiation time, the time-dependent crack growth, and the time at which gross failure occurs under time-varying applied forces and environmental parameters. The theory is applied to monolithic and composite materials under constant and varying loads. (Author Modified Abstract) GRA

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N73-27514 National Lending Library for Science and Technology, Boston Spa (England).
A SCHEME FOR OBJECTIVE ANALYSIS BY OPTIMAL INTERPOLATION
A. A. Kobjakova [1973] 9 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), v. 289, 1971 p 47-50 (NLL-M-22908-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A program is described for the single-level objective analysis of meteorological observations on a hemisphere. The program executes one of the schemes of the method of optimal interpolation and enables interpolated values of a meteorological element to be obtained at the grid points of an arbitrary network. Author

N73-27515 North Carolina Univ., Chapel Hill.
ON SOME BINARY SEARCH SYSTEMS USEFUL IN THE THEORY OF RANDOM SEARCH Ph.D. Thesis
Vinod Prakash Manglik 1972 96 p
Avail: Univ. Microfilms Order No. 73-4855

Given a nonempty set S and a system F of functions defined on S, the object of search is to detect an unknown element x in S, by observing the values of a sequence of test-functions f in F at x till there is enough information to detect x. Strongly homogeneous systems of order two in two symbols are found to be closely related to the incidence matrix of equireplicated pairwise balanced designs. Some systems of this type were constructed by using the incidence of subsets of points and m-flats of finite geometries. Properties of weakly homogeneous binary systems of order two were studied, and some systems constructed using association matrices and Hadamard matrices. The probabilities of termination of search using the incidence matrices of PG(2,2) and PG(2,3) as search systems are given. Two series of search systems processing an optimality property were also constructed. Dissert. Abstr.

N73-27516*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
STATISTICAL PROPERTIES OF FILTERED PSEUDORANDOM DIGITAL SEQUENCES FORMED FROM THE SUM OF MAXIMUM-LENGTH SEQUENCES
G. R. Wallace, Glenn D. Weathers (Ala. A and M Univ.), and Edward R. Graf (Auburn Univ.) 9 Jul. 1973 60 p refs
(NASA-TM-X-64758) Avail: NTIS HC $5.00 CSCL 12A

The statistics of filtered pseudorandom digital sequences called hybrid-sum sequences, formed from the modulo-two sum of several maximum-length sequences, are analyzed. The results indicate that a relation exists between the statistics of the filtered sequence and the characteristic polynomials of the component maximum length sequences. An analysis procedure is developed for identifying a large group of sequences with good statistical properties for applications requiring the generation of analog pseudorandom noise. By use of the analysis approach, the filtering process is approximated by the convolution of the sequence with a sum of unit step functions. A parameter reflecting the overall statistical properties of filtered pseudorandom sequences is derived. This parameter is called the statistical quality factor. A computer algorithm to calculate the statistical quality factor for the filtered sequences is presented, and the results for two examples of sequence combinations are included. The analysis reveals that the statistics of the signals generated with the hybrid-sum generator are potentially superior to the statistics of signals generated with maximum-length generators. Furthermore, fewer calculations are required to evaluate the statistics of a large group of hybrid-sum generators than are required to evaluate the statistics of the same size group of approximately equivalent maximum-length sequences. Author

N73-27517*# Maryland Univ., College Park. Computer Science Center.
TOPOLOGIES ON DIRECTED GRAPHS
Robert N. Lieberman Dec. 1972 82 p refs
(Grants NGL-21-002-008; NSF GJ-32258X)
(NASA-CR-133342; TR-214) Avail: NTIS HC $6.25 CSCL 12A

Given a directed graph, a natural topology is defined and relationships between standard topological properties and graph theoretical concepts are studied. In particular, the properties of connectivity and separatedness are investigated. A metric is introduced which is shown to be related to separatedness. The topological notions of continuity and homeomorphism. A class of maps is studied which preserve both graph and topological properties. Applications involving strong maps and contractions are also presented. Author

N73-27518*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE DEVELOPMENT OF ACCURATE AND EFFICIENT METHODS OF NUMERICAL QUADRATURE
T. Feagin Jun. 1973 17 p refs
(NASA-TM-X-66277; X-582-73-176) Avail: NTIS HC $3.00 CSCL 12A

Some new methods for performing numerical quadrature of an integrable function over a finite interval are described. Each method provides a sequence of approximations of increasing order to the value of the integral. Each approximation makes use of all previously computed values of the integrand. The points at which new values of the integrand are computed are selected in such a way that the order of the approximation is maximized. The methods are compared with the quadrature methods of Clenshaw and Curtis, Gauss, Patterson, and Romberg using several examples. Author

N73-27519*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN EXTENSION OF THE QZ ALGORITHM FOR SOLVING THE GENERALIZED MATRIX EIGENVALUE PROBLEM
Robert C. Ward Washington Jul. 1973 54 p refs
(NASA-TN-D-7305; L-8899) Avail: NTIS HC $3.00 CSCL 12A

This algorithm is an extension of Moler and Stewart's QZ algorithm with some added features for saving time and operations. Also, some additional properties of the QR algorithm which were not practical to implement in the QZ algorithm can be generalized with the combination shift QZ algorithm. Numerous test cases are presented to give practical application tests for algorithm. Based on results, this algorithm should be preferred over existing algorithms which attempt to solve the class of generalized eigenproblems where both matrices are singular or nearly singular. Author

N73-27520# Lockheed Missiles and Space Co., Palo Alto, Calif.
FUNDAMENTAL INFORMATION FROM THE THEORY OF MARKOV PROCESSES
G. V. Obrezkov and V. D. Razevig [1972] 28 p Transl. into ENGLISH from the book "Metody Analiza Sryva Slezheniia" Moscow, Sov. Radio, 1972 28 p
Avail: NTIS HC $3.50; National Translations Center, John Crerar Library, Chicago, Illinois 60616

The fundamental concepts of random Markov processes are outlined and their applications to nonlinear automatic regulation systems for the analysis of tracking disruption are described. G.G.

N73-27521# University of Southern Calif., Los Angeles. Dept. of Industrial and Systems Engineering.
RELIABILITY STUDY OF MULTICOMPONENT SYSTEMS

Final Report, 1 Apr. 1971 - 31 May 1973
Bennet P. Lientz May 1973 8 p refs
(Grant AF-AFOSR-2025-71; AF Proj. 9769; AF Proj. 9749)
(AD-760768; AFOSR-73-0860TR) Avail: NTIS CSCL 12/1

The technical areas included in the report are spare component allocation, communication network combinatorial problems, logistics, data management, operations analysis, scheduling, process control, search procedures, communication networks, and satellite tracking. (Author Modified Abstract) GRA

N73-27522# International Business Machines Corp., San Jose, Calif.
MAXIMUM LIKELIHOOD ESTIMATION OF PARAMETERS IN MULTIVARIATE GAUSSIAN STOCHASTIC PROCESSES
P. E. Caines (Stanford Univ.) and J. Rissanen May 1973 12 p refs
Avail: NTIS HC $3.00

A proof is outlined of the strong consistency of the maximum likelihood estimate of the parameters of Gaussian random processes possessing linear autoregressive moving average or state space representations. Author

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N73-27523 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA. VOLUME 99, NO. 4: INFRARED RADIATION MEASUREMENTS BY NIMBUS SATELLITES IN THE SPECTRAL WINDOW REGION OF 4 MICRONS AND THE SYNOPTIC METEOROLOGICAL EVALUATION OF DIGITAL MEASUREMENT DATA [METEOROLOGISCHE ABHANDLUNGEN. BAND 99, HEFT 4: INFRAROTSTRAHLUNGSMESSUNGEN DER NIMBUS-SATELLITEN IM SPEKTRALEN FENSTERBEREICH BEI 4 MIKRONE UND DIE METEOROLOGISCH-SYNOPTISCHE AUSWERTUNG DER DIGITALEN MESSDATEN]
Dieter Bothe 1972 134 p refs In GERMAN
Avail: Issuing Activity

Obtaining, transmitting and processing of infrared radiation data gained in spectral window regions by means of high resolution sensors (HRIR) is considered. The vertical and horizontal extensions of cloud systems can be well observed in the synoptic scale. Therefore these data present - besides the TV-picture - an excellent method for interpreting atmospheric conditions. In addition the temperature of the earth- or water-surface can be determined with an accuracy of about 2 C in cloudless areas in cases when the absolute water vapor contents of the air mass and the emissivity of the radiating surface is fairly well-known. The statistical treatment of large data finally shows that new values for all climatic regions of the earth can be obtained by systematical use of extensive observation material. Author

N73-27524 National Lending Library for Science and Technology, Boston Spa (England).
ONE-LEVEL POLYNOMIAL OBJECTIVE ANALYSIS OF METEOROLOGICAL FIELDS
I. I. Poljak [1973] 8 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), v. 289, 1971 p 33-38
(NLL-M-22903-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

An algorithm is described for interpolating the statistical structure of meteorological fields using the least squares method, and a program for the objective analysis of meteorological parameters is developed. The program inputs and outputs are also described. F.O.S.

N73-27525 Colorado State Univ., Fort Collins.
A PARAMETRIC MODEL OF CUMULUS CONVECTION Ph.D. Thesis
Raul Erlando Lopez 1972 111 p
Avail: Univ. Microfilms Order No. 73-2802

The interaction of cumulus convection with large-scale systems is perhaps the most fundamental problem confronting meteorology today. The main obstacle to the clarification of this problem, however, is the lack of understanding of the dynamics of individual cumulus clouds and of the processes by which they impart heat and mass to their surroundings. As a tool in the investigation of these subjects, a numerical time-dependent model has been developed that can simulate the entire life-cycle of different types of cumuli under different environmental conditions. Results of several cloud simulations under different environmental and initial conditions are presented. These illustrate the capability of the model in simulating the entire life-cycle of cumulus clouds subject to different forcing conditions.
Dissert. Abstr.

N73-27526 Illinois Inst. of Tech., Chicago.
RADAR MEASUREMENT OF THE ATMOSPHERIC TURBULENCE STRUCTURE FUNCTION Ph.D. Thesis
Robert Joseph Serafin 1972 90 p
Avail: Univ. Microfilms Order No. 73-3638

The problem of estimating the square of the difference of the mean frequencies of two stationary, statistically independent Gaussian random processes was investigated. Two methods for performing this function are considered. The first, a coherent radar estimator, use conventional pulse Doppler signal processing techniques. The second method of interest is that of Atlas and Srivastava for use with incoherent radars. An exact analytical treatment of the coherent estimator is given. However, direct analysis of the incoherent method is frustrated due to the complexity of the statistical problem involved. This is circumvented by defining and analyzing a third estimator mathematically similar in form to the expression of Atlas and Srivastava. An experimental laboratory simulation, using a breadboard of the incoherent detector, is described. The results of these experiments, analyzed with a digital computer, are shown to be in agreement with the theoretical developments. Dissert. Abstr.

N73-27527 Cincinnati Univ., Ohio.
THE ATMOSPHERIC DIFFUSION OF CARBON MONOXIDE AND LEAD FROM AN EXPRESSWAY Ph.D. Thesis
Donald Ray Lynam 1972 174 p
Avail: Univ. Microfilms Order No. 73-3827

This field investigation involved the use of carbon monoxide as an inert tracer to evaluate the transport and removal of lead particulates after their emission into the atmosphere by studying the relative behavior of the two materials. Multiple linear regression analysis and the statistical Gaussian diffusion model were utilized in predicting the atmospheric dispersion of lead and carbon monoxide from a high speed, heavily travelled expressway. The results should be useful to urban planners, highway design personnel, air pollution control officials, and environmental scientists who are concerned with traffic emission, and air quality implementation plans. The results can be applied to other automotive pollutants to determine their behavior in and effect on the environment. Dissert. Abstr.

N73-27528 Stanford Univ., Calif.
THE RELATION OF LOCAL PRESSURE FLUCTUATIONS TO LARGE SCALE METEOROLOGY AND THE SIMULATION OF ACOUSTIC-GRAVITY WAVES IN INHOMOGENEOUS MEDIA Ph.D. Thesis
Lee Lu 1972 88 p
Avail: Univ. Microfilms Order No. 73-4544

A digital data acquisition system was constructed and operated to investigate ground-level pressure fluctuations in 1 to 60 minutes period range. Pressure data were collected from a 7 km array of three microbarographs installed in the vicinity of Stanford University. The data were analyzed in association with weather maps. Large-scale phenomena such as jet streams and weather fronts had drastic effects on the 5-35 minutes period local pressure field. Lagged correlation studies showed that long period turbulence swept across the array in speed and direction comparable to those of the winds at 200 mb altitude. A numerical approximation method for extrapolating monochromatic acoustic-gravity waveforms in modestly inhomogeneous media is introduced. This method gives spatially transient solutions for acoustic-gravity waves from a point source in the x-z plane. It has been used to illustrate effects of wind or temperature on monochromatic waveforms of both telebaroms generated by

nuclear explosions and gravity waves generated by low speed jet streams. Dissert. Abstr.

N73-27529 Washington Univ., Seattle.
A DYNAMICAL MODEL OF THE INTERTROPICAL CONVERGENCE ZONE Ph.D. Thesis
Chih-Pei Chang 1972 125 p
Avail: Univ. Microfilms Order No. 73-3686

An investigation was made of the hypothesis that through the CISK process the critical latitude mechanism (mass convergence in the tropical planetary boundary layer tends to concentrate around the latitude where the Coriolis frequency equals the wave frequency) is responsible for the development of the ITCZ. The study consists of three parts: (1) a preliminary investigation on the frequency and depth dependence of covergence distribution in a linear and finite depth equatorial boundary layer wave model, (2) a study of growth rate of tropical waves due to CISK forcing, and (3) the formulation of a tropical wave-zonal flow interaction model in which the test of the hypothesis is carried out. The solutions of the linear equatorial boundary layer are found to be dependent on both the depth of the modeled boundary layer and the mode of symmetry about the equator. Dissert. Abstr.

N73-27530# Hosei Univ., Tokyo (Japan). Dept. of Geography.
STUDIES ON WIND-SHAPED TREES: THEIR CLASSIFICATION, DISTRIBUTION AND SIGNIFICANCE AS A CLIMATIC INDICATOR
Masatoshi Yoshino 1973 52 p refs
(Climatol-Notes-12) Avail: NTIS HC $4.75

A monograph covering discussion on wind-shaped trees is presented. Part 1 is devoted to the classification and grading of wind-shaped trees from the standpoint of ecological climatography. Scale of deformation of wind-shaped trees in six grades is given for three types in a table. Examples of observations in Slovenia, Yugoslavia, and in Hokkaido, Japan, are described. A good coincidence was seen in comparing the results revealed by the wind-shaped trees with the results observed instrumentally. Part 2 concerns the distribution of wind-shaped trees in the sub-alpine zone in Japan. Cross sections from the Japan Sea side to the Pacific side in Central Japan and in Tohoku District and from north to south (from Hokkaido to Central Japan) are given. The results are discussed in relation to macro- and micro-climatological conditions as well as the history of vegetation development and the topographical situations. Part 3 is a bibliography on wind-shaped trees in the world. Not only the papers, monographs and text books, but also popular literature which contains their photographs were included in this bibliography. Author

N73-27531# Hosei Univ., Tokyo (Japan). Dept. of Geography.
SELECTED BIBLIOGRAPHY ON WATER BALANCE OF MONSOON ASIA (3)
Twao Tsuchiya 1973 23 p refs
(Climatol-Notes-11) Avail: NTIS HC $3.25

A bibliography is presented of selected articles concerning the water balance of monsoon Asia, which includes Southeast Asia, China, Korea, Philippines, and Japan. This bibliography contains 204 references. Author

N73-27532# National Environmental Satellite Service, Washington, D.C.
APPLICATION OF METEOROLOGICAL SATELLITE DATA IN ANALYSIS AND FORECASTING
Rance W. Skidmore and James F. W. Purdom Mar. 1973 59 p refs
(ESSA-TR-NESC-51-Suppl-2; NOAA-AWS-TR-212) Avail: SOD $0.85 Domestic Postpaid or $0.60 GPO Bookstore CSCL 04B

Additional data is presented on mountain waves, synoptic cloud patterns, back-door cold front, cyclonically-curved cirrus bands, and mean wind speed in the troposphere. Author

N73-27533# Joint Publications Research Service, Arlington, Va.
SOVIET AEROMETEOROLOGICAL SERVICE DESCRIBED
Yu. Sobolev 23 Jul. 1973 10 p Transl. into ENGLISH from Aviatsiya i Kosmonavtika (Moscow), no. 5, May 1973 p 36-37 (JPRS-59581) Avail: NTIS HC $3.00

A discussion is given on the Air Force Aerometeorological Center which is responsible for formulating scientifically sound procedures and methods as analyzing meteorological conditions, predicting the elements, adopting new technical equipment for observing weather elements, and collecting meteorological information. Author

N73-27534# National Environmental Satellite Service, Washington, D.C.
ENVIRONMENTAL SATELLITE IMAGERY. KEY TO METEOROLOGICAL RECORDS DOCUMENTATION NO. 5.4, APRIL 1973
Jun. 1973 94 p refs
Avail: NTIS HC $6.75

Daily global satellite imagery of Northern and Southern Hemisphere cloud covers for April, 1973 is presented. The third satellite of the ITOS system carried a two channel radiometer sensitive to energy in the visible spectrum at 0.5 to 0.7 micrometers, and in the infrared region at 10.5 and 12.5 micrometers. The hemispheric mosaics presented are produced by computerized processing of radiometer data. G.G.

N73-27535# National Environmental Satellite Service, Washington, D.C.
ENVIRONMENTAL SATELLITE IMAGERY. KEY TO METEOROLOGICAL RECORDS DOCUMENTATION NO. 5.4, MAY 1973
May 1973 97 p refs
Avail: NTIS HC $7.00

The key to Meteorological Records Documentation (KMRD) No. 5.4 series is issued monthly to describe current cloud data obtained by NOAA's operational environmental satellites. It contains daily global satellite imagery in condensed form and is designed to assist users in selecting data for research and climatological use. The series was established to document operational data from the scanning radiometers of NOAA 2 and subsequent NOAA environmental satellites. Author

N73-27536# National Environmental Satellite Service, Washington, D.C.
ENVIRONMENTAL SATELLITE IMAGERY. KEY TO METEOROLOGICAL RECORDS DOCUMENTATION NO. 5.4, NOVEMBER - DECEMBER 1972
Dec. 1972 83 p refs
Avail: NTIS HC $6.25

Current cloud data obtained by operational environmental satellites are presented that contain daily global satellite imagery in condensed form as a guide to data stored and to assist users in selecting data for research and climatological use. The monthly issues usually are printed and distributed within one month after the close of the month of observation. Author

N73-27537# Environmental Protection Agency, Research Triangle Park, N.C.
NATIONWIDE AIR POLLUTANT EMISSION TRENDS, 1940 - 1970
James H. Cavender, David S. Kircher, and Alan J. Hoffman Jan. 1973 59 p refs
(AP-115) Avail: NTIS HC $5.00

Estimates are presented of trends in nationwide air pollutant emissions for the five major pollutants: sulfur oxides, particulates, carbon monoxide, hydrocarbons, and nitrogen oxides. Detailed emission estimates for 1969 and 1970 are also provided. The year 1969 was selected as the base year; emissions for other years were calculated using methods and criteria in effect for 1969. In general, emissions of sulfur oxides and nitrogen oxides steadily increased through 1970 while carbon monoxide, particulate, and hydrocarbon emissions peaked in 1968-1969 and either decreased or remained somewhat constant thereafter. Author

N73-27538# Israel Program for Scientific Translations, Ltd., Jerusalem.
ATMOSPHERIC CIRCULATION AND THE RELATED WIND FIELDS OVER THE NORTH PACIFIC
A. I. Sorkina 1971 223 p refs Transl. into ENGLISH from the monograph "Tipy atmosfernoi tsirkulyatsii i svyazannykh s nei vetrovykh polei nad severnoi chastyu tikhogo okeana" Gidrometeorologicheskoe Izdateistvo (Otdelenie), Moscow, 1963

248 p Prepared for NSF
(TT-70-50129) Avail: NTIS HC $13.25

Atmospheric processes over the Pacific are studied with the aim of preparing climatological material for the compilation of schemes showing the types of distribution of wind waves and wind driven currents as well as seasonal and annual variations in the hydrologic ocean regime. Frequency and duration of life cycles of various mechanisms in different seasons and months on the basis of diurnal synoptic data, of actual occuring circulation mechanisms, and of earlier studied mean seasonal conditions, are considered. The basic order of transformation of one form of atmospheric circulation into another and the seasonal changes of these transformations are observed, and the formation of annual and seasonal changes in the type of atmospheric circulation over the ocean is outlined. Author

N73-27539# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, SEPTEMBER 1972
1973 313 p refs
Avail: NTIS HC $17.75

Daily upper air data, corrected for temperature error and curvature of the earth, are presented for Japan and its vicinity. The tables include standard pressure levels, temperature and humidity levels, wind levels, pilot-balloon data, and rocketsonde data. Author

N73-27540# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, AUGUST 1972
1972 317 p
Avail: NTIS HC $18.00

Daily upper air data, corrected for temperature error and curvature of the earth, are presented for Japan and its vicinity. The tables include standard pressure levels, temperature and humidity levels, wind levels, pilot-balloon data, and rocketsonde data. Author

N73-27541# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, OCTOBER 1972
1973 311 p refs
Avail: NTIS HC $17.75

Daily upper air data, corrected for temperature error and curvature of the earth, are presented for Japan and its vicinity. The tables include standard pressure levels, temperature and humidity levels, wind levels, pilot-balloon data, and rocketsonde data. Author

N73-27542# Bureau of Mines, Bartlesville, Okla. Energy Research Center.
THE ASSOCIATION OF AUTOMOTIVE FUEL COMPOSITION WITH EXHAUST REACTIVITY
Basil Dimitriades, B. H. Eccleston, G. P. Sturm, Jr., and C. J. Raible 1973 51 p refs Sponsored in part by EPA
(BM-RI-7756) Avail: NTIS HC $4.75

The association of automotive fuel composition with exhaust reactivity was studied in an experimental program that involved testing with different automotive engines and with gasolines of varied composition. Results showed clearly the exhaust reactivity to increase with increasing levels of polyalkylbenzenes in the fuel. No other systematic patterns of high significance were detected in the association of exhaust reactivity with several broadly defined groups of fuel components. Classification of fuel components in terms of the paraffins-olefins-aromatics groups does not meet the latter requirements. For appropriate classification of fuel components more information is needed on the combustion of hydrocarbons in the multicylinder internal combustion engine. Statistical analysis of the mass emissions data showed significant car and fuel effects on hydrocarbon, carbon monoxide, nitric oxide, total aldehydes, and formaldehyde emission levels and on total photochemical reactivity. Car-fuel interactions were not significant at the 90-pct level. Correlations were found between mass emission parameters and fuel composition. Author

N73-27543# Pakistan Space and Upper Atmosphere Research Committee, Karachi.
DATA REPORT: HIGH ALTITUDE METEOROLOGICAL DATA, 1964 - 1970
Oct. 1971 139 p refs
(W-119;) Avail: NTIS HC $9.00

Tabular and graphical data are presented of high altitude meteorological parameters measured at Sonmiani, Pakistan, during the period 1964-1970. Judi Dart rockets with copper chaff payloads were used for most of the firings. A.L.

N73-27544*# Pennsylvania State Univ., University Park.
VARIATION OF THE LOW LEVEL WINDS DURING THE PASSAGE OF A THUNDERSTORM GUST FRONT Technical Report, Jan. - Nov. 1972
R. W. Sinclair, R. A. Anthes, and H. A. Panofsky Washington NASA Jul. 1973 73 p refs
(Contract NAS8-27334)
(NASA-CR-2289) Avail: NTIS HC $3.00 CSCL 04B

Three time histories of wind profiles in thunderstorm gust fronts at Cape Kennedy and three at Oklahoma City are analyzed. Wind profiles at maximum wind strength below 100 m follow logarithmic laws, so that winds above the surface layer can be estimated from surface winds once the roughness length is known. A statistical analysis of 81 cases of surface winds during thunderstorms at Tampa revealed no predictor with skill to predict the time of maximum gust. Some 34% of the variance of the strength of the gust is accounted for by a stability index and surface wind prior tc the gust; the regression equations for these variables are given. The coherence between microscale wind speed variations at the different levels has the same proportions as in non-thunderstorm cases. Author

N73-27545# National Meteorological Center, Washington, D.C. Development Div.
A SEMI-IMPLICIT VERSION OF THE SHUMAN-HOVERMALE MODEL
Joseph P. Gerrity, Jr., Ronald D. McPherson, and Stephen Scolnik Jul. 1973 49 p refs
(NOAA-TM-NWS-NMC-53) Avail: NTIS HC $4.50

The numerical weather prediction model, developed by Shuman and Hovermale, was reformulated to accommodate the use of a semi-implicit integration method. The derivation of the finite difference equations for the new model is given. A technique is presented for solving the system of simultaneous equations that arises from the derivation. Author

N73-27546*# Environmental Research and Technology, Inc., Lexington, Mass.
USE OF 4-D ATMOSPHERIC MODELS IN THE SIMULATION OF RADIOMETRIC MEASUREMENTS
David T. Chang and Mary Grace Fowler Jul. 1973 116 p refs
(Contract NAS8-28720)
(NASA-CR-129007; P-417) Avail: NTIS HC $8.00 CSCL 04B

Atmospheric moisture data contained in the Global 4-D Atmospheric Models developed in previous studies were analyzed to establish regional differences. The regional values of precipitable water along latitudinal belts were compared with values derived from the corresponding atmospheric models defined in the U.S Standard Atmosphere Supplement. The effects of the differences between the 4-D Models and the Standard Atmosphere Models on radiometric computations in the infrared window and water vapor absorption band regions were evaluated using a standard computation model of radiation transfer through a cloudless atmosphere. The significance of these differences in simulation is discussed. Author

N73-27547# Stockholm Univ. (Sweden). Inst. of Meteorology.
MEASUREMENTS OF SCATTERED SUNLIGHT IN THE MESOSPHERE DURING TWILIGHT
Georg Witt, James E. Dye (Natl. Center for Atmospheric Res., Boulder, Colo.), and Nathan Wilhelm Feb. 1973 63 p refs
(Contracts RN-1-26; RN-1-31; RN-1-32; RN-1-36a)
(AP-8) Avail: NTIS HC $5.25

Two photoelectric polarimeters with transmission bands centered at 256 and 536 nm were flown on ESRO Centaur rocket C-32/2 from Kiruna, Sweden, at 2101 Z on 8 June 1968 to investigate molecular scattering in the mesosphere. It also studied possible deviations from molecular scattering which existed at the time of flight. Both photometers detected increased scattering in a region between 85.5 and 89 km on

ascent and descent. This excess scattering is interpreted as being due to a layer of particulate matter. The high degree of polarization measured in both wavelength regions suggests that, if the particles are of uniform radius, this radius is about 0.05 microns or less depending on the refractive index assumed. This conclusion is supported by the observed contrast between the layer and molecular background at both wavelengths.
Author (ESRO)

N73-27548# Montana State Univ., Bozeman. Dept. of Earth Sciences.
ATMOSPHERIC WATER RESOURCES MANAGEMENT PROGRAM, PART 1 Final Report
A. B. Super, C. A. Grainger, J. T. McPartland, V. L. Mitchell, and R. H. Yaw 15 Feb. 1972 437 p refs
(Contract DI-14-06-D-6798)
(PB-2180512; REC-14-06-D-6798) Avail: NTIS HC$6.00 CSCL 04B

Randomized winter orographic cloud seeding experiments conducted in the Bridger Range of southwestern Montana during 1969 and 72 are discussed. The experiments were to determine meteorological conditions under which groundbased silver iodide seeding could modify mountain snowfall in the Northern Rockies. Experiments aimed at developing a practical scheme for direct detection of cloud seeding effects are described. Several snowfall characteristics including ice crystal types, concentrations, and sizes were examined before, during, and after seeding events with encouraging results. Radar was used in several special experiments, including attempts to directly detect seeding effects, detailed analysis of the spatial and temporal variability of orographic storms, and measurments of precipitation tops. (Author Modified Abstract) GRA

N73-27549# Chicago Univ., Ill. Cloud Physics Lab.
UNIVERSITY OF CHICAGO CONTRIBUTION TO PROJECT METROMEX-1 Final Technical Report, 1 May 1971 - 31 Dec. 1972
Roscoe R. Braham, Jr. 15 Dec. 1972 105 p refs
(Grant NSF GA-28190)
(PB-218678/1; US-CPL-TN-45-1972) Avail: NTIS HC $3.00 CSCL 04B

Research carried out by the Univ. of Chicago Cloud Physics Lab on inadvertent weather modification in the St. Louis Area as part of Project Metromex, is presented. Measurements made over and around St. Louis, Mo. show that city markedly affects several atmospheric parameters important in the formation of clouds and weather. Based upon three periods of study (2 mid-summer and 1 winter) the city was found to act as a source of anthropogenic cloud condensation nuclei with a source strength of 0.5 to 5 x 10 to the 4th power/ccsec. (Author Modified Abstract) GRA

N73-27550# Oregon State Univ., Corvallis. Dept. of Forest Engineering.
ENERGY EXCHANGE STUDIES AT THE EARTH'S SURFACE. 1: ENERGY BUDGETS OF DESERT, MEADOW, FOREST AND MARSH SITES
Lloyd W. Gay Jan. 1973 104 p refs Sponsored in part by Dept. of Interior
(PB-218825/8; OWRR-A-001-ORE(18)-Vol-1; W73-07423; TR-73-9) Avail: NTIS HC $3.00 CSCL 04B

The energy exchange characteristics of four common landscape types in the high semi arid plateau in central Oregon, east of the Cascade Range, were evaluated during the summers of 1969 and 1971. The surfaces studied were pumice, meadow, forest, and marsh. A portable environmental data acquisition system was developed for sampling micrometeorological variables with a high degree of precision. The construction and operation of the system is described. The system was deployed for various periods during mid- to late summer at the four experimental sites. Clear weather periods were selected for analysis in order to examine the energy exchange processes at a time of maximum activity. The mean energy budget components for two such clear days were calculated. GRA

N73-27551# Environmental Protection Agency, Ann Arbor Mich. Test and Evaluation Branch.
EXHAUST EMISSION ANALYSIS OF THE WILLIAMS RESEARCH GAS TURBINE AMC HORNET
Leonard D. Verrelli and Casimer J. Andary May 1972 15 p
(PB-218687/2; APTD-1410; Rept-72-27) Avail: NTIS HC $3.00 CSCL 13B

An evaluation was made of field experience with a turbine powered passenger car. The William Gas Turbine Wr-26, regenerative turbine automotive engine was mounted in a 1971 Hornet test vehicle. The engine uses a single power turbine to develop 80 horsepower. The engine regenerator incorporates two large discs of a ceramic-glass material for inlet air preheating. Testing was accomplished using the 1970, 1972, and 1975 Federal Test Procedures. In addition, steady state and proportional sampler tests were conducted. By positioning of the power turbine bypass in the closed position, it was demonstrated that low hydrocarbon emissions are possible with this engine; however carbon monoxide and nitric oxides were not reduced sufficiently to be able to meet 1975 or 1976 emission standards. GRA

N73-27552# Washington Univ., Seattle. Dept. of Electrical Engineering.
REMOTE DETERMINATION OF THE PROFILES OF THE ATMOSPHERIC STRUCTURE CONSTANTS AND WIND VELOCITY ALONG A LINE-OF-SIGHT PATH BY A STATISTICAL INVERSION PROCEDURE
J. Michael Heneghan and Akira Ishimaru Jan. 1973 46 p refs
(Contract F19628-72-C-0063; AF Proj. 8682)
(AD-760805; SR-1; TR-157; AFCRL-TR-73-0136) Avail: NTIS CSCL 04/2

A method is developed for remotely determining the average transverse wind velocity and the atmospheric structure constant (strength of turbulence) at N points along a line-of-sight path. The technique avoids the basic instability problem that was encountered in previous work, limiting the calculations to one or two points. Linear integral equations relate the data, the amplitude correlation function and the amplitude and phase structure functions, with the unknown structure constant and wind velocity. The standard inversion method leads to large variations in the unknown for small data errors; thus, the problem is ill posed. To counteract this, a statistical inversion procedure is developed that is dependent upon a priori knowledge of the statistics of the unknowns. The error in the final solution can also be predicted by computer simulation. For example, with an input error of one percent, the RMS error in the unknown will be on the order of ten percent. This is an increase in accuracy of ten orders of magnitude over the standard inverse moment method. Author (GRA)

N73-27553# Brier (Glenn W.), Fort Collins, Colo.
VALIDITY OF THE AIR QUALITY DISPLAY MODEL CALIBRATION PROCEDURE Final Report
Glenn W. Brier Jan. 1973 34 p refs
(PB-218716/9; EPA-R4-73-017) Avail: NTIS HC $3.00 CSCL 13B

The study examines, from the point of view of statistical theory, the validity of the calibration procedure that is currently used with climatological models of multiple-source urban air pollution (such as the Air Quality Display Model), and particularly its use as a basis for predictions of air quality that would result from distributions of emissions differing from that for which the calibration was actually established. Suggestions are made that would make the procedure more meaningful. Author(GRA)

N73-27554# Environmental Protection Agency, Ann Arbor Mich. Test and Evaluation Branch.
EVALUATION OF NASA THERMAL REACTOR
Henry L. Gompf Apr. 1972 4 p
(PB-218639/3; APTD-1405; Rept-72-21) Avail: NTIS HC $3.00 CSCL 13B

A reactor-equipped vehicle was tested for assessment of the emissions control of the NASA automotive thermal reactor technology program. The NASA reactor was tested on a 1971 Ford pickup equipped with a 302 CID engine and automatic transmission. The reactor was evaluated in two configurations: with and without flame holders. Testing at two different idle mixture settings in each configuration was also accomplished. Emission testing was done using hot start 1972 FTP and cold

start 1975 FTP. Test results indicate that none of the tests approach 1975 or 1976 required levels. Results indicate the following shortcomings for the reactor: reactor warm-up time must be shortened; control of CO is minimal; the use of the flame holders appears to be of little benefit in this design. GRA

N73-27555# Environmental Protection Agency, Washington, D.C.
CONTROL STRATEGIES FOR IN-USE VEHICLES
Nov. 1972 205 p refs
(PB-218942/1; APTD-1469) Avail: NTIS HC $6.75 CSCL 13B

The major results are presented of recent studies and evaluations made by the Environmental Protection Agency of the feasibility, emission reduction effectiveness, and costs of the various hardware approaches to in-use vehicle emission control. These include programs of periodic inspection and maintenance; the retrofitting of emission control systems to vehicles or the installation of more effective emission control systems and the conversion of motor vehicles to permit their operation using gaseous fuels. GRA

N73-27556# California State Div. of Highways, Sacramento.
AIR QUALITY MANUAL. VOLUME 1: METEOROLOGY AND ITS INFLUENCE ON THE DISPERSION OF POLLUTANTS FROM HIGHWAY LINE SOURCES Interim Report, Jun. 1971 - Apr. 1972
John L. Beaton, Andrew J. Ranzieri, and John B. Skog Apr. 1972 169 p refs
(Contract FH-11-7730)
(PB-219811/7; CA-HWY-MR6570825(1)-72-11-V-1) Avail: NTIS HC $6.00; also available as a set of 8 reports NTIS HC $28.40, as PB-219810 CSCL 13B

Highway engineers need to consider a variety of factors in the environmental impact of any highway project. This report explains the basic fundamentals of meteorology and their effect on pollutant concentrations on and within the highway corridor. It discusses (1) the general relationship between meteorology and air pollution, (2) the role of meteorology in the transport and dispersion of air pollutants, (3) a method to estimate the surface stability of the atmosphere, (4) meteorological surveys, (5) meteorological factors to be considered in highway route location, (6) a highway line source model for analyzing meteorological data, and (7) sources of meteorological data. GRA

N73-27557# California State Div. of Highways, Sacramento.
AIR QUALITY MANUAL. VOLUME 2: MOTOR VEHICLE EMISSION FACTORS FOR ESTIMATES OF HIGHWAY IMPACT ON AIR QUALITY Interim Report, Jun. 1971 - Apr. 1972
John L. Beaton, Andrew J. Ranzieri, and John B. Skog Apr. 1972 68 p refs
(Contract FH-11-7730)
(PB-219812/5; CA-HWY-MR6570825(2)-72-10-V-2) Avail: NTIS HC $4.50; also available as a set of 8 reports NTIS HC $28.40, as PB-219810 CSCL 13B

Highway engineers need to consider a variety of factors in the environmental impact of any highway project. The emission factors which are most representative of vehicles using freeways, local roads, and streets are reported. The emission factors take into account the vehicle deterioration factors, model year, annual mileage traveled, and average route speed. The developed emission factors are based on the best data currently available. GRA

N73-27558# Illinois State Water Survey, Urbana.
CLIMATOLOGY OF INSTANTANEOUS PRECIPITATION RATES Final Report, 15 Nov. 1971 - 14 Feb. 1973
Arthur L. Sims and Douglas M. A. Jones Mar. 1973 85 p refs
(Contract F19628-72-C-0052; AF Proj. 8624)
(AD-760785; AFCRL-TR-73-0171) Avail: NTIS CSCL 04/2

Nearly instantaneous precipitation rates have been calculated for existing data from several locations and for records collected specifically for this project. Point frequencies of occurrence of 1-minute rates have been derived and are tabulated by months for one year of data from Preston and Reading, England; for two years of data from Paris, France; and for three years of data from Urbana, Illinois. Frequencies of 4-minute rates are tabulated for a year of data each from Albuquerque, New Mexico; Bismarck, North Dakota; Seattle, Washington; Bet Dagan, Israel; Koblenz, Germany; and Freiburg, Germany. Four-minute frequencies for two years of data from Naha, Okinawa, are tabulated. Frequencies of 2-minute average rates along lines have been tabulated for lines of raingages up to 39 miles in length in central Illinois. The frequencies of occurrence of maximum rates along these lines are also included. (Author Modified Abstract) GRA

N73-27559# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
DISPERSION OF TRACERS IN THE ATMOSPHERE: SURVEY OF METEOROLOGICAL DATA
Ernest Bauer Feb. 1973 33 p refs
(Contract DAHC15-73-C-0200)
(AD-760694; P-925; IDA/HQ-72-14733) Avail: NTIS CSCL 04/1

Data on the dispersion of clouds of tracers in the atmosphere, as a function of time after injection, are presented for a variety of altitudes from the planetary boundary layer up to turbopause; these data supplement the compilations of Hage (1964) and Hage et al (1966). Within the admittedly wide range of variability of these data, there is no evidence that the behavior for the horizontal dispersion differs between the planetary boundary layer, troposphere, and lower stratosphere. The data show the effective, horizontal eddy diffusivity as being scale-dependent. Results for the lower atmosphere (0-30 km), for the upper atmosphere (80-110 km), and for the ocean near the surface are compared. (Author Modified Abstract) GRA

N73-27560# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
PREVAILING WIND DIRECTIONS IN THE ARCTIC OCEAN
Michael A. Bilello Mar. 1973 102 p refs
(ARPA Order 1615)
(AD-761074; CRREL-RR-306) Avail: NTIS CSCL 04/2

Prevailing monthly and seasonal surface wind directions were obtained from (1) weather records for 21 coastal stations around the Arctic Ocean and (2) a series of U.S. Navy wind charts for 15 to 20 locations in the arctic marginal seas and the ocean's interior. This information was combined and analyzed to develop 2 charts which depict the surface flow of air in these areas during the mid-summer and mid-winter months. Since the ice flow stations used in the offshore wind analysis are not permanently located, the Arctic Ocean was selectively divided into 6 zones. Three of these zones separate Polar regions north of 84 degrees latitude, and 3 other zones each separate the seas bordering the north coasts of Europe, Siberian Russia and North America. GRA

N73-27561# Naval Postgraduate School, Monterey, Calif. Dept. of Meteorology.
TYPHOON AND TROPICAL STORM INTENSITY FORECASTS USING STATISTICAL REGRESSION EQUATIONS M.S. Thesis
Glenn Gray Coltrane Mar. 1973 59 p refs
(AD-761379) Avail: NTIS CSCL 04/2

Statistical regression equations were derived to predict future 24-hour changes in intensity of tropical storms and typhoons in the western North Pacific. The predictors were chosen from 55 parameters available at six-hourly observations of tropical storms and typhoons during the period 1960-1969. Two five-predictor equations, which require only 12 hours of history, can predict intensity for the majority of storms within the period July-September, and give significantly better results than current intensity forecast methods. GRA

N73-27562# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. Research Library.
ABSTRACTS FROM PROCEEDINGS OF INSTITUTE OF EXPERIMENTAL METEOROLOGY, ISSUE 23, PHYSICS OF AERODISPERSION SYSTEMS
2 Mar. 1973 20 p refs Transl. into ENGLISH from Tr. Inst. Eksperim. Meteorol. (USSR), no. 23, 1971 p 176-184
(AD-760753; AFCRL-TR-73-0115; AFCRL-Trans-102) Avail: NTIS CSCL 04/2

The report consists of a table of contents and eleven abstracts concerning various studies in meteorology. GRA

N73-27563# Transport and Road Research Lab., Crowthorne (England).
ATMOSPHERIC POLLUTION FROM VEHICLE EMISSIONS: MEASUREMENTS IN READING, 1971
D. M. Colwill 1973 26 p refs
(PB-219602/0; TRRL-LR-541) Avail: NTIS HC $3.00 CSCL 13B

The concentrations of a number of pollutants were measured at two sites in Reading, England during a summer and a winter period of 1971. One monitoring site was at the kerbside of a heavily trafficked road and the other at a site remote from traffic in order that the contribution of motor vehicles to pollutant levels in an urban area could be observed. Carbon monoxide, hydrocarbon, nitrogen oxides, sulphur dioxide, lead and smoke concentrations were monitored at both sites; traffic was counted at the kerbside site and climatic conditions were also recorded. The level of pollution at the kerbside was found to be considerably greater than that at the site remote from the traffic indicating that traffic can contribute significantly to pollutant levels in urban areas. The relationship between pollutant levels and traffic is discussed. Author (GRA)

N73-27564# California State Div. of Highways, Sacramento.
AIR QUALITY MANUAL. VOLUME 3: TRAFFIC INFORMATION REQUIREMENTS FOR ESTIMATES OF HIGHWAY IMPACT ON AIR QUALITY Interim Report, Jun. 1971 - Apr. 1972
John L. Beaton, Earl C. Shirley, and John B. Skog Apr. 1972 37 p refs
(Contract DOT-FH-11-7730)
(PB-219813/3; CA-HWY-MR6570825(3)-72-09; FHWA-RD-72-35) Avail: NTIS HC $3.75; paper copy also available from NTIS $28.40/set of 8 reports as PB-219810-set CSCL 13B

Highway engineers have to consider a variety of factors in the environmental impact of any highway project. This manual explains the reasoning behind the method of air quality analysis which includes a consideration of traffic information. It also provides an understanding of the relationship between the traffic parameters and the way in which air quality is affected. GRA

N73-27565# California State Div. of Highways, Sacramento.
AIR QUALITY MANUAL. VOLUME 4: MATHEMATICAL APPROACH TO ESTIMATING HIGHWAY IMPACT ON AIR QUALITY Interim Report, Jun. 1971 - Apr. 1972
John L. Beaton, Andrew J. Ranzieri, Earl C. Shirley, and John B. Skog Apr. 1972 71 p refs
(Contract DOT-FH-11-7730)
(PB-219814/1; CA-HWY-MR6570825(4)-72-08; FHWA-RD-72-36) Avail: NTIS HC $4.50; paper copy also available from NTIS $28.40/set of 8 reports as PB-219810-set CSCL 13B

Highway engineers have to consider a variety of factors in the environmental impact of any highway project. This manual explains a method of predicting pollutant concentrations within an area of study with and without the new highway. The prediction analysis includes both the highway corridor and the mesoscale. The highway corridor is defined as a region extending from the point where the pollutants are generated by traffic (the highway) downwind to the point where ambient pollutant levels are again reached. The mesoscale area is defined as the area throughout which traffic volumes on the surface traffic network are significantly affected by the construction of a new highway. GRA

N73-27566# California State Div. of Highways, Sacramento.
AIR QUALITY MANUAL. VOLUME 6: ANALYSIS OF AMBIENT AIR QUALITY FOR HIGHWAY PROJECTS Interim Report, Jun. 1971 - Apr. 1972
John L. Beaton, Andrew J. Ranzieri, Earl C. Shirley, and John B. Skog Apr. 1972 112 p refs
(Contract DOT-FH-11-7730)
(PB-219816/6; CA-HWY-MR6570825(5)-72-07V-6; FHWA-RD-72-38-Vol-6) Avail: NTIS HC $5.45; paper copy also available from NTIS $28.40/set of 8 reports as PB-219810-set CSCL 13B

Highway engineers have to consider a variety of factors in the environmental impact of any highway project. This manual explains the interaction between air pollutant sources and meteorological conditions contributing to the ambient air quality of a community. Air pollutant sources within a highway corridor normally include stationary and mobile sources. Stationary sources include domestic heaters, industrial installations and power plants. Mobile sources include motor vehicle traffic on highways, local roads and streets. Guidelines are presented to: (1) determine the present ambient air quality along a proposed highway corridor from existing air monitoring station data, (2) determine the present ambient air quality by performing an on-site air quality survey, and (3) perform a mesoscale analysis of ambient air quality. GRA

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N73-27567*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
SIRU DEVELOPMENT. VOLUME 3: SOFTWARE DESCRIPTION AND PROGRAM DOCUMENTATION Final Report
John Oehrle Mar. 1973 193 p
(Contract NAS9-8242)
(NASA-CR-128965; R-746-Vol-3) Avail: NTIS HC $11.75 CSCL 17G

The development and initial evaluation of a strapdown inertial reference unit (SIRU) system are discussed. The SIRU configuration is a modular inertial subsystem with hardware and software features that achieve fault tolerant operational capabilities. The SIRU redundant hardware design is formulated about a six gyro and six accelerometer instrument module package. The six axes array provides redundant independent sensing and the symmetry enables the formulation of an optimal software redundant data processing structure with self-contained fault detection and isolation (FDI) capabilities. The basic SIRU software coding system used in the DDP-516 computer is documented. Author

N73-27568# National Aviation Facilities Experimental Center, Atlantic City, N.J.
VISUAL APPROACH SLOPE INDICATOR (VASI) IMPROVEMENTS Final Report, Jun. 1968 - Jan. 1973
Thomas H. Paprocki Jul. 1973 8 p refs
(FAA Proj. 071-312-000)
(FAA-NA-73-64; FAA-RD-73-96) Avail: NTIS HC $3.00 CSCL 17G

The major work to improve and update Visual Approach Slope Indicator (VASI) equipment and systems being utilized at various category airports within the United States is discussed. Results and conclusions arrived at through a number of of VASI evaluation projects are cited in so far as they pertain to the following areas of VASI development and investigation: (1) suitability of VASI for long-bodied aircraft use; (2) techniques for reducing VASI lateral beam coverage; (3) visual approach multiple slope indicator (VAMSI) concept development; and (4) VASI signal transition zone and color modifications. Reference to previous and interim reports providing detailed information about each of the subject areas is provided. Author

N73-27569*# Weston Instruments, Inc., College Park, Md. EMR Aerospace Sciences.
PANORAMIC ATTITUDE SENSOR FOR RADIO ASTRONOMY EXPLORER B Final Report, Jul. 1971 - Jan. 1973
R. Thomsen Jun. 1973 82 p
(Contract NAS5-11464)
(NASA-CR-132782) Avail: NTIS HC $6.25 CSCL 17G

An instrument system to acquire attitude determination data for the RAE-B spacecraft was designed and built. The system consists of an electronics module and two optical scanner heads. Each scanner head has an optical scanner with a field of view of 0.7 degrees diameter which scans the sky and measures the

position of the moon, earth and sun relative to the spacecraft. This scanning is accomplished in either of two modes. When the spacecraft is spinning, the scanner operates in spherical mode, with the spacecraft spin providing the slow sweep of lattitude to scan the entire sky. After the spacecraft is placed in lunar orbit and despun, the scanner will operate in planar mode, advancing at a rate of 5.12 seconds per revolution in a fixed plane parallel to the spacecraft Z axis. This scan will cross and measure the moon horizons with every revolution. Each scanner head also has a sun slit which is aligned parallel to the spin axis of the spacecraft and which provides a sun pulse each revolution of the spacecraft. The electronics module provides the command and control, data processing and housekeeping functions. Author

N73-27570*# Weston Instruments, Inc., College Park, Md. EMR Aerospace Sciences.
PANORAMIC ATTITUDE SENSOR FOR RADIO ASTRONOMY EXPLORER-B, APPENDICES Final Report
Jun. 1973 123 p
(Contract NAS5-11464)
(NASA-CR-132783) Avail: NTIS HC $8.25 CSCL 17G
For abstract, see N73-27569.

N73-27571# Royal Aircraft Establishment, Farnborough (England).
A STAR-POINTING ATTITUDE CONTROL SYSTEM FOR SKYLARK
J. K. Abbott Dec. 1971 25 p
(RAE-TR-71241; BR28129) Avail: NTIS HC $3.25
A three-axis star-pointing attitude control system was developed for the Skylark sounding rocket. The system uses a simple strap-down inertial system to carry out precision maneuvers to locate the target star, starting from an initial moon-pointing orientation. The star sensor is capable of providing adequate error information for stars down to visual magnitude 5. Author

N73-27572# Army Electronics Command, Fort Monmouth, N.J.
LORAN/INERTIAL SIMULATION PROCEDURES
William R. Light, Jr. and Matthew J. Fisher Apr. 1973 76 p refs
(DA Proj. 1F1-62202-A-96)
(AD-761027; ECOM-4112) Avail: NTIS CSCL 17/7
Economic considerations require the investigation of alternatives to high precision navigation sensors. One alternative is a hybrid loran/inertial system whose components: accuracy specifications are somewhat relaxed. The hybrid system uses the long term position error stability of loran to restrain the divergent inertial platform error. The inertial system provides velocity, altitude, and heading as well as smoothed position as required. The synthesis of such a system depends on the establishment of a good computer simulation approach which, in turn, relies upon valid sensor models. Sensor model development begins with the constraints of Army mission requirements and a knowledge of the hardware, continues with the determination of an appropriate mathematical model, and concludes with a hardware verification phase. (Author Modifier Abstract) GRA

N73-27573# Army War Coll., Carlisle Barracks, Pa.
AIRSPACE COORDINATION - WHO NEEDS IT?
James A. Kilgore 14 Feb. 1973 28 p refs
(AD-761034) Avail: NTIS CSCL 01/2
The theme is based upon the Army's need to coordinate airspace. Data were gathered using a literature search. The airspace above the combat zone is used by all services and by all combat branches within the Army. History indicates control of the airspace became a problem during World War I. Between World War I and World War II new concepts for integration of air into the land battle scheme were developed. Korea brought new innovations and produced combat experience in the helicopter for the Army. The Vietnam War produced the concept of airmobility that further increased airspace control problems. There is no current agreement on joint use of the airspace. Doctrine provides for an Airspace Coordination Element (ACE) that, currently, is not authorized on most TOEs. The ACE, although a workable solution, is restricted by being only a planning and management facility with limited capability. Air Defense Artillery has recommended consolidation of selected equipment with aviation to help solve the airspace problem. (Author Modified Abstract) GRA

N73-27574# Transportation Systems Center, Cambridge, Mass.
SIGNAL ANALYSIS FOR AEROSAT Final Report, Jan. - Jun. 1972
L. A. Frasco Aug. 1972 79 p refs
(AD-758407; DOT-TSC-FAA-72-29; FAA-RD-73-34) Avail: NTIS CSCL 17/7
The report addresses signal design for the AEROSAT system. Candidate data and surveillance modems are analyzed for L-Band avionics. Detailed theoretical analyses are presented of the effects of the oceanic satellite-aircraft channel on data modem performance. In addition, an L-Band avionics transceiver is proposed to meet the requirements of the Experimentation and Evaluation Phase of AEROSAT. The proposed avionics are flexible and easily adaptable to a variety of operational and access control concepts. A task plan outline is presented for an improved modem task for the following year. Author (GRA)

N73-27819* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DELTA LAUNCH VEHICLE INERTIAL GUIDANCE SYSTEM (DIGS)
Kenneth I. Duck *In its* Significant Accomplishments in Technol. 1973 p 14-15 (For availability see N73-27816 18-34)
CSCL 17G

N73-27820* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STRAP 4 SOUNDING ROCKET ATTITUDE CONTROL SYSTEM
David J. Shrewsberry *In its* Significant Accomplishments in Technol., 1972 1973 p 16-19 (For availability see N73-27816 18-34)
CSCL 17G

N73-27821* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INERTIAL REFERENCE UNIT
Frederick J. Kull *In its* Significant Accomplishments in Technol., 1972 1973 p 20-21 (For availability see N73-27816 18-34)
CSCL 17G

N73-27822* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FINE POINTING CONTROL, OAO-3
James V. Moore *In its* Significant Accomplishments in Technol., 1972 1973 p 22-24 (For availability see N73-27816 18-34)
CSCL 17G

N73-27850* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPACECRAFT REORIENTATION VIA SLEWING ABOUT NONORTHOGONAL AXES
Paul B. Davenport *In its* Significant Accomplishments in Technol., 1972 1973 p 140-142 (For availability see N73-27816 18-34)
CSCL 17G

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N73-27575*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REACTOR MODERATOR, PRESSURE VESSEL, AND HEAT REJECTION SYSTEM OF AN OPEN-CYCLE GAS CORE NUCLEAR ROCKET CONCEPT

Maynard F. Taylor, Charles L. Whitmarsh, Jr., Paul J. Sirocky, Jr., and Louis C. Iwanczyke Washington Jul. 1973 44 p refs
(NASA-TM-X-2772; E-6588) Avail: NTIS HC $3.00 CSCL 21F

A preliminary design study of a conceptual 6000-megawatt open-cycle gas-core nuclear rocket engine system was made. The engine has a thrust of 196,600 newtons (44,200 lb) and a specific impulse of 4400 seconds. The nuclear fuel is uranium-235 and the propellant is hydrogen. Critical fuel mass was calculated for several reactor configurations. Major components of the reactor (reflector, pressure vessel, and waste heat rejection system) were considered conceptually and were sized. Author

N73-27576*# Gulf General Atomic, San Diego, Calif.
FABRICATION AND LIFE TESTING OF THERMIONIC CONVERTERS Final Report
L. Yang and R. Bruce Jun. 1973 109 p refs
(Contract NAS3-12980)
(NASA-CR-121180; Gulf-GA-A12554) Avail: NTIS HC $7.50 CSCL 18I

An unfueled converter containing a chloride-fluoride duplex tungsten emitter of 4.78 eV vacuum work function was tested for 46,647 hours at an emitter temperature of 1973 K and an electrode power output of about 8 watts/sq cm. The test demonstrated the superior and stable performance of the (110) oriented tungsten emitter at high temperatures. Three 90 UC-10 ZrC(C/U = 1.04, tungsten additive = 4 wt %) fueled converters were fabricated and tested at an emitter temperature of 1873 K. Converter containing chloride-arc-cast duplex tungsten cladding showed temperature thermionic performance and slower rate of performance drop than converter containing chloride-fluoride duplex tungsten cladding. This is believed to be due to the superior fuel component diffusion resistance of the arc-cast tungsten substrate used in the fuel cladding. It was shown that a converter containing a carbide fueled chloride-arc-cast duplex tungsten emitter with an initial electrode power output of 6.80 watts/sq cm could still deliver an electrode power output of 6.16 watts/sq cm after 18,632 hours of operation at an emitter temperature of 1873 K. Author

N73-27577*# National Reactor Testing Station, Idaho Falls, Idaho.
FEASIBILITY STUDY OF FULL-REACTOR GAS CORE DEMONSTRATION TEST
J. F. Kunze, J. H. Lofthouse, C. J. Shaffer, and P. J. Macbeth Jun. 1973 67 p refs
(NASA Order C-597188)
(NASA-CR-121190; ANCR-1120) Avail: NTIS HC $5.50 CSCL 18I

Separate studies of nuclear criticality, flow patterns, and thermodynamics for the gas core reactor concept have all given positive indications of its feasibility. However, before serious design for a full scale gas core application can be made, feasibility must be shown for operation with full interaction of the nuclear, thermal, and hydraulic effects. A minimum sized, and hence minimum expense, test arrangement is considered for a full gas core configuration. It is shown that the hydrogen coolant scattering effects dominate the nuclear considerations at elevated temperatures. A cavity diameter of somewhat larger than 4 ft (122 cm) will be needed if temperatures high enough to vaporize uranium are to be achieved. Author

N73-27578*# National Reactor Testing Station, Idaho Falls, Idaho.
FLOWING GAS, NON-NUCLEAR EXPERIMENTS ON THE GAS CORE REACTOR
J. F. Kunze, C. G. Cooper, and P. J. Macbeth Jun. 1973 81 p refs
(NASA Order C-545588)
(NASA-CR-121191; ANCR-1118) Avail: NTIS HC $6.25 CSCL 18I

Variations in cavity wall and injection configurations of the gas core reactor were aimed at establishing flow patterns that give a maximum of the nuclear criticality eigenvalue. Correlation with the nuclear effect was made using multigroup diffusion theory normalized by previous benchmark critical experiments. Air was used to simulate the hydrogen propellant in the flow tests, and smoked air, argon, or Freon to simulate the central nuclear fuel gas. Tests were run both in the down-firing and upfiring directions. Results showed that acceptable flow patterns with volume fraction for the simulated nuclear fuel gas and high flow rate ratios of propellant to fuel can be obtained. Using a point injector for the fuel, good flow patterns are obtained by directing the outer gas at high velocity long the cavity wall, using louvered injection schemes. Recirculation patterns were needed to stabilize the heavy central gas when different gases are used. Author

N73-27579*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DOPEX-1D2C: A ONE-DIMENSIONAL, TWO-CONSTRAINT RADIATION SHIELD OPTIMIZATION CODE
Gerald P. Lahti Washington Jul. 1973 31 p refs
(NASA-TM-X-2836; E-7421) Avail: NTIS HC $3.00 CSCL 18F

A one-dimensional, two-constraint radiation sheild weight optimization procedure and a computer program, DOPEX-1D2C, is described. The DOPEX-1D2C uses the steepest descent method to alter a set of initial (input) thicknesses of a spherical shield configuration to achieve a minimum weight while simultaneously satisfying two dose-rate constraints. The code assumes an exponential dose-shield thickness relation with parameters specified by the user. Code input instruction, a FORTRAN-4 listing, and a sample problem are given. Typical computer time required to optimize a seven-layer shield is less than 1/2 minute on an IBM 7094. Author

N73-27580*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SHIELD MATERIALS RECOMMENDED FOR SPACE POWER NUCLEAR REACTORS
Leonard J. Kaszubinski Washington Jul. 1973 36 p refs
(NASA-TM-X-2835; E-7347) Avail: NTIS HC $3.00 CSCL 18F

Lithium hydride is recommended for neutron attenuation and depleted uranium is recommended for gamma ray attenuation. For minimum shield weights these materials must be arranged in alternate layers to attenuate the secondary gamma rays efficiently. In the regions of the shield near the reactor, where excessive fissioning occurs in the uranium, a tungsten alloy is used instead. Alloys of uranium such as either the U-0.5Ti or U-8Mo are available to accommodate structural requirements. The zone-cooled casting process is recommended for lithium hydride fabrication. Internal honeycomb reinforcement to control cracks in the lithium hydride is recommended. Author

N73-27581*# Science, Technology and Research, Inc., Atlanta, Ga.
DYNAMIC ANALYSIS OF GAS-CORE REACTOR SYSTEM Final Report
Kyle H. Turner, Jr. Mar. 1973 79 p refs
(Contract NAS3-16735)
(NASA-CR-121253) Avail: NTIS HC $6.00 CSCL 18I

A heat transfer analysis was incorporated into a previously developed model CODYN to obtain a model of open-cycle gaseous core reactor dynamics which can predict the heat flux at the cavity wall. The resulting model was used to study the sensitivity of the model to the value of the reactivity coefficients and to determine the system response for twenty specified perturbations. In addition, the model was used to study the effectiveness of several control systems in controlling the reactor. It was concluded that control drums located in the moderator region capable of inserting reactivity quickly provided the best control. Author

N73-27582*# Atomics International, Canoga Park, Calif.
SPACE NUCLEAR SYSTEM VOLUME ACCUMULATOR DEVELOPMENT (SNAP PROGRAM) Summary Report
W. D. Whitaker and T. T. Shimazaki 30 Jun. 1973 50 p refs
(NASA Order C-21030-C; Contract AT(04-3)-701)
(NASA-CR-121245; AI-AEC-13090) Avail: NTIS HC $4.50 CSCL 18I

The engineering, design, and fabrication status of the volume accumulator units to be employed in the NaK primary

and secondary coolant loops of the 5-kwe reactor thermoelectric system are described. Three identical VAU's are required - two for the primary coolant loop, and one for the secondary coolant loop. The VAU's utilize nested-formed bellows as the flexing member, are hermetically sealed, provide double containment and utilize a combination of gas pressure force and bellows spring force to obtain the desired pressure regulation of the coolant loops. All parts of the VAU, except the NaK inlet tube, are to be fabricated from Inconel 718. Author

N73-27583*# Atomics International, Canoga Park, Calif.
VOLUME ACCUMULATOR DESIGN ANALYSIS COMPUTER CODES
W. D. Whitaker and T. T. Shimazaki 30 Jun. 1973 30 p refs
(NASA Order C-21030-C; Contract AT(04-3)-701)
(NASA-CR-121246; AI-AEC-13094) Avail: NTIS HC $3.50 CSCL 18I

The computer codes, VANEP and VANES, were written and used to aid in the design and performance calculation of the volume accumulator units (VAU) for the 5-kwe reactor thermoelectric system. VANEP computes the VAU design which meets the primary coolant loop VAU volume and pressure performance requirements. VANES computes the performance of the VAU design, determined from the VANEP code, at the conditions of the secondary coolant loop. The codes can also compute the performance characteristics of the VAU's under conditions of possible modes of failure which still permit continued system operation. Author

N73-27584*# Westinghouse Astronuclear Lab., Pittsburgh, Pa.
FABRICATION OF CAPSULE ASSEMBLIES, PHASE 3 Final Report
A. R. Keeton and L. G. Stemann Mar. 1973 128 p ref
(Contract NAS3-15332)
(NASA-CR-121181; WANL-M-FR-73-002) Avail: NTIS HC $8.50 CSCL 18I

Thirteen capsule assemblies were fabricated for evaluation of fuel pin design concepts for a fast spectrum lithium cooled compact space power reactor. These instrumented assemblies were designed for real time test of prototype fuel pins. Uranium mononitride fuel pins were encased in AISI 304L stainless steel capsules. Fabrication procedures were fully qualified by process development and assembly qualification tests. Instrumentation reliability was achieved utilizing specially processed and closely controlled thermocouple hot zone fabrication and by thermal screening tests. Overall capsule reliability was achieved with an all electron beam welded assembly. Author

N73-27585*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CONCEPTUAL DESIGN AND THERMAL ANALYSIS OF THE EXHAUST DUCT FOR A FISSIONING URANIUM PLASMA TEST REACTOR
Henry A. Putre Washington Aug. 1973 21 p refs
(NASA-TM-X-2861; E-7457) Avail: NTIS CSCL 18I

The conceptual design and analysis of a film cooled exhaust duct for a gas core rocket test cavity is described. The cavity exhaust has a temperature of 4000 K and 200 atmospheres of pressure. The film cooled duct design uses seeded hydrogen coolant flow to reduce the duct outlet temperature to 850 K, and the maximum duct wall temperature to below 700 K. With this design less than 1 percent of the uranium fuel flow rate in the exhaust plates out on the duct walls. Author

N73-27586*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTER OPTIMIZATION OF REACTOR-THERMOELECTRIC SPACE POWER SYSTEMS
William L. Maag, Patrick M. Finnegan, and Laurence H. Fishbach Washington Aug. 1973 17 p refs
(NASA-TM-X-2860; E-7446) Avail: NTIS HC $3.00 CSCL 18E

A computer simulation and optimization code that has been developed for nuclear space power systems is described. The results of using this code to analyze two reactor-thermoelectric systems are presented. Author

N73-27587*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IRRADIATION TEST OF TUNGSTEN CLAD URANIUM CARBIDE-ZIRCONIUM CARBIDE ((U,Zr)C) SPECIMENS FOR THERMIONIC REACTOR APPLICATION AT CONDITIONS CONDUCTIVE TO LONG-TERM PERFORMANCE
John W. R. Creagh and John R. Smith Washington Aug. 1973 20 p refs
(NASA-TM-X-2834; E-7440) Avail: NTIS HC $3.00 CSCL 18J

Uranium carbide fueled, thermionic emitter configurations were encapsulated and irradiated. One capsule contained a specimen clad with fluoride derived chemically vapor deposited (CVD) tungsten. The other capsule used a duplex clad specimen consisting of chloride derived on floride derived CVD tungsten. Both fuel pins were 16 millimeters in diameter and contained a 45.7-millimeter length of fuel. Author

N73-27588*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IRRADIATION OF TZM: URANIUM DIOXIDE FUEL PIN AT 1700 K
Glen E. McDonald Washington Jul. 1973 19 p refs
(NASA-TM-X-2755; E-7277) Avail: NTIS HC $3.00 CSCL 18J

A fuel pin clad with TZM and containing solid pellets of uranium dioxide was fission heated in a static helium-cooled capsule at a maximum surface temperature of 1700 K for approximately 1000 hr and to a total burnup of 2.0 percent of the uranium-235. The results of the postirradiation examination indicated: (1) A transverse, intergranular failure of the fuel pin occurred when the fuel pin reached 2.0-percent burnup. This corresponds to 1330 kW-hr/cu cm, where the volume is the sum of the fuel, clad, and void volumes in the fuel region. (2) The maximum swelling of the fuel pin was less than 1.5 percent on the fuel-pin diameter. (3) There was no visible interaction between the TZM clad and the UO2. (4) Irradiation at 1700 K produced a course-grained structure, with an average grain diameter of 0.02 centimeter and with some of the grains extending one-half of the thickness of the clad. (5) Below approximately 1500 K, the irradiation of the clad produced a moderately fine-grained structure, with an average grain diameter of 0.004 centimeter. Author

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology; and 29 Space Radiation.

N73-27589 Iowa State Univ. of Science and Technology, Ames.
THE EFFECTS OF CHEMICAL ETCHING ON THE MAGNETIC PROPERTIES OF PERMALLOY FILMS Ph.D. Thesis
Hai Young Lee 1972 80 p
Avail: Univ. Microfilms Order No. 73-3905

Several different etching solutions were used to investigate their different effects on the magnetic properties of as-deposited magnetic thin films. Examining the results of electron micrographs and polishing of etched film surfaces, it is found that the chemical etching may have three different mechanisms which can act simultaneously: At first, it reduces film thickness, second, it produces microscopic surface roughness, and finally, it may etch down through grain boundaries or voids of thin films. The contributions of these mechanisms may be dependent upon the choice of etching solution, its concentrations, etch time, temperature, and the structure, of film itself. It is observed that the increase in the coercive force and the angular dispersion during the etch in 20 percent HC1 + HNO3 solution were mainly attributed to the thickness reduction and the microscopic surface roughness produced by the chemical etching. Dissert. Abstr.

N73-27590 Brown Univ., Providence, R.I.
ABSORPTION OF ULTRASOUND IN LIQUID METALS AND IN LIQUID SELENIUM Ph.D. Thesis

Eugene Martin Ring 1972 154 p
Avail: Univ. Microfilms Order No. 73-2324

Evidences of structural relaxation effects in the liquid metal alloy system Hg-Tl have been reported in the literature, referred to in numerous review articles, and reinvestigated in this study, which was motivated by negative findings in the tin-bismuth alloy system. Pulse-echo measurements in Hg-Tl between 15 MHz and 325 MHz in the temperature range from 2 C to 106 C reveal that no relaxation absorption exists in the system in these domains. The present results are compatible with the previous results if the correction for diffraction losses is not made. The results of the measurements in liquid metal and liquid metal alloy systems are also presented. The temperature and frequency dependence of the ultrasonic absorption in molten selenium were studied in the range from 200 C to 400 C, and from 30 MHz to 70 MHz. The data are consistent with the literature in the high-temperature range from 350 C to 600 C, but supersede previous results in the range from 200 C to 350 C.

Dissert. Abstr.

N73-27591# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.

AN APPLICATION OF CROSS SPECTRAL ANALYSIS TO THE MEASUREMENT OF CONTRIBUTION OF NOISE SOURCES

Yasushi Ishii and Masahiro Ishida May 1972 9 p refs
(ISAS-493) Avail: NTIS HC $3.00 CSCL 20A

The measurement of the contributions of noise sources is to determine the amount of acoustic power contributed to the field at a given point by each of several sources. The signal from the microphone placed at an observation point is cross-correlated with the signal from the second microphone placed sufficiently close to a noise source. The measured cross-correlation function is converted into the cross-spectral density through digital computations and then divided by the power-spectrum of the signal from the second microphone, giving the frequency transfer function between the noise source and the observation point. Using the computed transfer function, the component due to the source in question is separated from the total sound power-spectrum at the observation point. Some preliminary experiments including the separation of exhaust noise of an automobile were made, and the results verified the effectivenesss of this cross-spectral method. Author

N73-27592# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.

FAR FIELD RADIATION OF ROTOR-STATOR INTERACTION TONES FROM AN ANNULAR DUCT

G. Krishnappa and L. R. Jones Apr. 1973 25 p refs
(NRC-13260; LR-568) Avail: NTIS HC $3.25 CSCL 20A

An expression is derived to calculate the directivity of the far field sound pressure levels radiated from an annular duct based on Tyler and Sofrin's approach for a circular duct. Both radial and circumferential variations in the acoustic pressure field inside the duct are considered in the derivation. A computer program to calculate the generation, propagation and far field radiation of tones from a single stage ducted fan is described. Some illustrative examples are worked out to show the effect of hub/tip ratio on the far field directivity. Computed results for the cases considered in Tyler and Sofrin's paper are in close agreement. Author

N73-27593# Joint Publications Research Service, Arlington, Va.

FEASIBILITY OF GENERATING MEGAGAUSS MAGNETIC FIELDS USING HIGH-PRESSURE COMPRESSED GAS LININGS

Ye. P. Velikhov, A. A. Vedenov, A. D. Bogdanets, V. S. Golubev, E. G. Kasharskiy, A. A. Kiselev, F. G. Rutberg, and V. V. Chernukha 9 Jul. 1973 17 p refs Transl. into ENGLISH from Zh. Tekhn. Fiz. (Moscow), v. 43, no. 2, 1973 p 429-438
(JPRS-59459) Avail: NTIS HC $3.00

The results of calculation of a setup, designed for generating a megagauss pulse magnetic field in a large volume, are reported. Author

N73-27594*# North Carolina State Univ., Raleigh. Center for Acoustical Studies.

INVESTIGATION OF THE STATISTICS OF PURE TONE SOUND POWER INJECTION FROM LOW FREQUENCY, FINITE SIZED SOURCES IN A REVERBERANT ROOM Ph.D. Thesis

Wayne Farrior Smith May 1973 112 p refs
(Grant NGL-05-018-127)
(NASA-CR-132279) Avail: NTIS HC $7.75 CSCL 20A

The effect of finite source size on the power statistics in a reverberant room for pure tone excitation was investigated. Theoretical results indicate that the standard deviation of low frequency, pure tone finite sources is always less than that predicted by point source theory and considerably less when the source dimension approaches one-half an acoustic wavelength or greater. A supporting experimental study was conducted utilizing an eight inch loudspeaker and a 30 inch loudspeaker at eleven source positions. The resulting standard deviation of sound power output of the smaller speaker is in excellent agreement with both the derived finite source theory and existing point source theory, if the theoretical data is adjusted to account for experimental incomplete spatial averaging. However, the standard deviation of sound power output of the larger speaker is measurably lower than point source theory indicates, but is in good agreement with the finite source theory. Author

N73-27595*# Scientific Translation Service, Ann Arbor, Mich.

CALCULATION OF TRANSIENT CURRENTS AND FORCES IN TOROIDAL COIL SYSTEMS FOR FUSION MACHINES

R. Pohlchen and H. Preis Washington NASA Aug. 1973 21 p refs Transl. into ENGLISH from Max-Planck-Inst. fuer Plasmaphys., Garching, West Germany, report IPP-4/107
(Contract NASw-2483)
(NASA-TT-F-15013; IPP-4/107) Avail: NTIS HC $3.25 CSCL 20C

Methods of calculating the electrical behavior of toroidal coil configurations and the magnetic forces in the coil system in cases of sudden disturbance of normal (stationary or quasi-stationary) operation are presented. After it has been shown how to calculate the self-inductances and mutual inductances of the coil system, an explanation is given of the mesh scheme for obtaining the matrix equations of the network. The currents thus calculated are then used to determine the total magnetic field and hence the Lorentz forces. Author

N73-27596*# Boeing Aerospace Co., Huntsville, Ala.

STUDY OF LIQUID-SOLID TRANSITION FOR MATERIALS PROCESSING IN SPACE. ANALYSIS OF FIELD EFFECTS ON DENSE LIQUID MATERIALS Final Report

R. I. Miller 9 May 1973 47 p refs
(Contract NAS8-28664)
(NASA-CR-124294; D5-17254) Avail: NTIS HC $4.50 CSCL 20D

The behavior of dense liquids near the solidification point under the influence of magnetic fields or near-zero gravity conditions were analyzed within the framework of existing liquid state models and classical field theory. The dynamic body forces which are an effect of the magnetic field on liquids are discussed. It is concluded that both magnetic fields and low gravity conditions produce an increase in the diffusion coefficient which result in an increased growth rate of crystals, and time varying magnetic fields induce eddy currents in the liquid which produce body forces and tend to disrupt convection. F.O.S.

N73-27597# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).

DEVICE FOR CONTINUOUSLY VARIABLE PULSE DELAY Final Report [ETUDE D'UN DISPOSITIF POUR DONNER A DES IMPULSIONS UN RETARD REGLABLE DE MANIERE CONTINUE RAPPORT FINAL]

P. Defranould 3 Dec. 1971 39 p In FRENCH
(Contract DRME-70/34-202-00-480-75-01)
Avail: NTIS HC $4.00

Theoretical and experimental work on a continuously variable acousto-optical delay line, which is based on photoelastic interaction in corundum and rutile, uses the frequency range 1200 to 1800 MHz, and is variable from a few nsec to 4 microsec, is reported. A possible application is radar calibration and simulation. The relatively high losses of 30 db above the theoretical level of the ideal system, can be reduced by further

improvement. The gain of the line is proportional to the square of the optical power, and a loss reduction of 10 db can be obtained by using a 20 mW laser instead of the 6 mW laser used. ESRO

N73-27598# Southampton Univ. (England). Inst. of Sound and Vibration Research.
THE CHARACTERISATION OF WAVE PROPAGATION MECHANISMS USING TRANSIENT EXCITATION: NON-DISPERSIVE WAVES IN SIMPLE LUMPED SYSTEMS
Philip J. Holmes Nov. 1972 132 p refs Sponsored by Min. of Defence
(ISVR-TR-57) Avail: NTIS HC $8.75

A study of non-dispersive wave propagation in lumped systems is carried out, with reference to the development of experimental techniques for the measurement of system parameters. In particular structural systems were studied. Transient, rapid frequency sweep excitation is used, and both cross correlation and spectral analysis techniques are considered. Single and multipath delay systems with and without resonant elements are discussed and it is shown that with a suitable choice of excitation parameters, the system characteristics can be successfully deduced. The theoretical analyses of the various systems are supplemented by a series of model tests using analog and digital computer simulation. Finally a number of results obtained from tests on practical systems are considered. Author (ESRO)

N73-27599# Stanford Research Inst., Menlo Park, Calif.
MATERIALS PROCESSING OF RARE EARTH-COBALT PERMANENT MAGNETS Semiannual Interim Technical Report, 1 Jul. - 31 Dec. 1972
Paul J. Jorgensen and Robert W. Bartlett Feb. 1973 69 p refs
(Contract F33615-70-C-1624; ARPA Order 1617; SRI Proj. PYU-8731)
(AD-760777; AFML-TR-73-60; SAIR-5) Avail: NTIS CSCL 09/1

The objectives of the program are to investigate materials processing methods with the goal of achieving optimum properties of SmCo5 and other RECo5 compounds as permanent magnets. The primary problem is achieving high magnetic coercivity. Studies to gain further knowledge of the liquid-phase sintering process and magnetic evaluation of sintered alloys were carried out prior to this research period, and studies of the final stage of sintering (solid-state process) were conducted during this period and are reported. Selective internal oxidation of samarium invariably accompanies magnet powder processing. A study of the kinetics of oxidation and the morphology of the oxide subscale was completed during this period. Studies on oxygen solubility in SmCo5 and the precipitation of oxide inclusions during quenching and aging are reported. A study of Sm2Co(17) precipitation in samarium-depleted SmCo5 grains is included. GRA

N73-27600# Naval Postgraduate School, Monterey, Calif.
OPTIMUM THRESHOLD DETECTION FOR AN INFRARED NUTATING DETECTION SYSTEM M.S. Thesis
William Earl Major, II Mar. 1973 135 p refs
(AD-761380) Avail: NTIS CSCL 17/5

A threshold detection system based on the Neyman-Pearson criterion is derived for an infrared nutating optical system. Detection is optimum for small signal-to-noise ratios and a Gaussian uncertainty in the pointing error of the optical system. The signal spectrum and background power spectral density for a rectangular space filter are computed numerically and used to specify the matched filter for the threshold detection system and evaluate its performance. Author (GRA)

N73-27601# Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.
RESOLUTION ENHANCEMENT OF DISCRETE OPTICAL SENSORS
Eugene S. McVey and Karl C. Henderson Apr. 1973 18 p refs
(Grant AF-AFOSR-2195-72; AF Proj. 9769)
(AD-760779; EE-3418-102-73U; AFOSR-73-0831TR) Avail: NTIS CSCL 20/6

An image enhancement technique for black and white images is formulated as a linear estimation problem with no a priori assumptions about the image. The mapping matrix is derived, and a solution and implementation are presented for least square error minimization. The solution is given as the product of the pseudoinverse of the mapping matrix and the observation vector. An example is presented and future efforts are discussed. Author (GRA)

N73-27602# Arizona Univ., Tucson. Optical Sciences Center.
FURTHER STUDIES AND INVESTIGATIONS IN OPTICAL TECHNOLOGY
R. Brian Hooker, Howard E. Morrow, Richard Philbrick, James D. Rancourt, Roland V. Shack, and Neil Sullivan Wright-Patterson AFB, Ohio AFAL Mar. 1973 100 p ref
(Contract F33615-72-C-1222; AF Proj. 7646)
(AD-760564; AFAL-TR-73-75) Avail: NTIS CSCL 20/6

The development and evaluation of aerial cameras and reconnaissance systems requires the use of sophisticated tools and techniques. Several previously developed tools have been expanded, and a new tool has been developed. The computer program FROLIC is used to aid in the design analysis of optical systems. The program has been expanded to determine the effect of tilted and decentered optical elements such as may result from manufacturing errors. The Polarization Interferometer, an instrument capable of measuring wavefront perturbations to better than lambda/100, has been modified to give a profile display of a wavefront section in addition to a contour map display. The signals used to produce the profile display are suitable, with proper buffering, for input to a computer which could calculate the optical transfer function of the system under test. (Author Modified Abstract) GRA

N73-27603# Naval Research Lab., Orlando, Fla. Underwater Sound Reference Div.
METROLOGY STANDARDS OF THE UNDERWATER SOUND REFERENCE DIVISION
Robert J. Bobber 30 May 1973 12 p refs
(NRL Proj. S02-37; RR01108)
(AD-761147; NRL-MR-2593) Avail: NTIS CSCL 20/1

Metrology standards used or planned by the Underwater Sound Reference Division and their traceability to the National Bureau of Standards are described. Author (GRA)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N73-27604 National Lending Library for Science and Technology, Boston Spa (England).
THEORETICAL CALCULATION OF FINE STRUCTURE TERMS OF DOUBLY IONIZED VANADIUM AND MANGANESE ATOMS IN BASIC CONFIGURATIONS
S. A. Zhvironaite and K. V. Kostantinavichyus Feb. 1973 21 p refs Transl. into ENGLISH from Liet. Fiz. Rinkinys (Vilnyus), v. 2, no. 1-2, 1962 p 17-31
(NLL-RTS-7856) Avail: Natl. Lending Library, Boston Spa, Engl.: £2.00; 7 NLL photocopy coupons

Fine structure terms of V(III) in the d3 configuration and of Mn(III) in the d5 configuration are investigated. Values of radial integrals of the electrostatic and spin intearctions, obtained by means of solutions of the self consistent field, and values of term splitting intervals, are given. The theoretically obtained results are compared with available experimental data. Author

N73-27605 California Univ., San Diego.
APPLICATION OF FREE JET SOURCES TO REACTIVE CROSSED MOLECULAR BEAM EXPERIMENTS Ph.D. Thesis
Dan Frazier Patch 1972 235 p
Avail: Univ. Microfilms Order No. 73-4424

The differential reaction cross section for the reaction CS2 + O yields CS + SO was studied at intermediate and rebound

scattering angles using free jet sources in a crossed molecular beam apparatus. A high pressure radio frequency discharge was developed to produce a high intensity source of fast oxygen atoms. O atom beam properties and discharge efficiency for dissociating O2 were determined for all source conditions. Scattering data obtained for intermediate and rebound scattering angles indicated that the differential reaction cross section is much smaller in the rebound direction. An upper limit for the differential reaction cross section of 0.19 A squared/steradian was determined for rebound collisions. Dissert. Abstr.

N73-27606 Wisconsin Univ., Madison.
DYNAMIC PROPERTIES OF NEUTRAL EXCITATIONS PRODUCED IN ELECTRON-BOMBARDED SUPERFLUID HELIUM Ph.D. Thesis
John Wayne Keto 1972 140 p
Avail: Univ. Microfilms Order No. 72-31539

The dynamic properties of the He(2 3S) and the He2(a 3 sigma hyperon u+) atomic and molecular metastable states of helium and the fluorescence of more highly excited molecules produced in electron bombarded superfluid helium. The steady state concentration of (v = 0) He2(a 3 sigma hyperon u+) molecules is shown to be limited by collisions between pairs of these molecules. The rate coefficient for this bilinear destruction mechanism is estimated to be about 2 x 10 to the minus 10 power cu cm/sec at 2.08 K, and it is observed to vary strongly with the temperature in a manner that is rougly inversely proportional to the roton concentration in the superfluid. Dissert. Abstr.

N73-27607 North Carolina State Univ., Raleigh.
ELECTRON MOBILITY IN ALLOYS OF DIRECT BAND GAP III-V COMPOUNDS Ph.D. Thesis
James William Harrison, Jr. 1972 232 p
Avail: Univ. Microfilms Order No. 73-1871

The pseudo-binary model is used to deduce the variation with composition of the material parameters used in theoretical calculations of electron mobility. A description of the design and operation of a reactor for vapor phase deposition of epitaxial GaxIn1-xAs alloys on germanium substrates is given. With the system, alloys across the composition spectrum were made. Subsequent electrical measurements to determine the Hall constant and resistivity of the epitaxial layers found a low electron mobility due to the presence of a large number of impurities. The suspected source of the impurities was the germanium substrates and similar difficulties by other workers are cited. The model for the pseudo-binary alloy mobilities is applied, modified by the necessity for degenerate statistics in the calculation due to the high doping levels. Reasonable agreement is found between theory and experiment. Dissert. Abstr.

N73-27608 Tennessee Univ., Knoxville.
ELECTRON SCATTERING FROM SIMPLE ATOMIC AND MOLECULAR SYSTEMS: A STUDY OF THE PHENOMENOLOGICAL AND MICROSCOPIC OPTICAL MODELS Ph.D. Thesis
Gerald Dodd Alton 1972 135 p
Avail: Univ. Microfilms Order No. 73-2415

Optical potential methods of analysis are used to study low energy electron scattering from simple atoms and molecules. In order to specify the optical potential which is used to describe the collisional phenomena in question it is possible to take either a semi-empirical or a theoretical approach. Both of these approaches are used in this study. In the studies made with the phenomenological optical model, an attempt is made to obtain physically reasonable potential functions which will reproduce certain experimentally observed electron-hydrogen, electron-helium scattering data. Local complex potentials, characterized by energy dependent parameters, are used to generate elastic and inelastic scattering cross sections which are compared with experimental measurements for the processes studied. Dissert. Abstr.

N73-27609*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OPTICAL POTENTIAL APPROACH TO THE ELECTRON-ATOM IMPACT IONIZATION THRESHOLD PROBLEM
A. Temkin and Y. Hahn (Conn. Univ.) Jul. 1973 55 p refs Submitted for publication
(NASA-TM-X-66282; X-641-73-195) Avail: NTIS HC $4.75 CSCL 20H

The problem of the threshold law for electron-atom impact ionization is reconsidered as an extrapolation of inelastic cross sections through the ionization threshold. The cross sections are evaluated from a distorted wave matrix element, the final state of which describes the scattering from the Nth excited state of the target atom. The actual calculation is carried for the e-H system, and a model is introduced which is shown to preserve the essential properties of the problem while at the same time reducing the dimensionability of the Schrodinger equation. Nevertheless, the scattering equation is still very complex. It is dominated by the optical potential which is expanded in terms of eigen-spectrum of QHQ. It is shown by actual calculation that the lower eigenvalues of this spectrum descend below the relevant inelastic thresholds; it follows rigorously that the optical potential contains repulsive terms. Analytical solutions of the final state wave function are obtained with several approximations of the optical potential. Author

N73-27610*# California Univ., Santa Barbara. Dept. of Mechanical Engineering.
THE RELATIVISTIC DYNAMICS OF A POINT CHARGE IN THE FIELD OF A PLANE ELECTROMAGNETIC WAVE TRAVELING IN THE DIRECTION OF A UNIFORM STATIC MAGNETIC FIELD
Thomas P. Mitchell Jun. 1973 18 p refs
(Grant NGL-05-010-020)
(NASA-CR-132781) Avail: NTIS HC $3.00 CSCL 20H

The motion of a charged particle in electromagnetic fields of various geometric configurations and arising from a variety of sources is of intrinsic interest in electromagnetic theory. The particular configuration consisting of a plane wave propagating in the presence of a static uniform magnetic field whose direction is parallel to the wave normal is examined. The analysis presented here is treated within the context of classical electromagnetic theory. A numerical solution - at least to the approximate Lorentz-Dirac equation - is obtained. Author

N73-27611*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SCATTERING OF 42 MeV ALPHA PARTICLES FROM COPPER-65
William M. Stewart and Kamal K. Seth (Northwestern Univ.) Washington Jul. 1973 29 p refs
(NASA-TN-D-7354; E-7404) Avail: NTIS HC $3.00 CSCL 20H

Beams of 42-MeV alpha particles were elastically and inelastically scattered from Cu-65 in an attempt to excite states which may be described in terms of an excited core model. Angular distributions were measured for 17 excited states. Seven of the excited states had angular distributions similar to a core quadrupole excitation and eight of the excitied states had angular distributions similar to a core octupole excitation. The excited state at 2.858 MeV had an angular distribution which suggests that it may have results from the particle coupling to a two-phonon core state. An extended particle-core coupling calculation was performed and the predicted energy levels and reduced transition probabilities compared to the experimental data. The low lying levels are described quite well and the wavefunctions of these states explain the large spectroscopic factors measured in stripping reactions. For Cu-65 the coupling of the particle to the core is no larger weak as in the simpler model, and configuration mixing results. Author

N73-27612*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Physics.
LIST OF TECHNICAL REPORTS AND CONFERENCES ON PION RESEARCH Final Report
Kazuo Gotow, David A. Jenkins, David K. Anderson, Marvin Blecher, and Richard Powers Feb. 1973 8 p refs
(Grant NGL-47-004-033; Proj. 313177)
(NASA-CR-132280) Avail: NTIS HC $3.00 CSCL 20H

Lists of the Ph.D. theses, publications, and talks given at professional meetings based on research in medium energy physics are presented. G.G.

N73-27613# Rome Univ. (Italy). Inst. of Physics.
HADRON PAIR PRODUCTION BY ELECTRON-POSITRON COLLIDING BEAMS
G. Barbiellini (CNEN, Frascati, Italy), F. Ceradini, M. Conversi, S. Dangelo, G. Giannoli, M. Grilli (CNEN, Frascati, Italy), E. Iarocci (CNEN, Frascati, Italy), M. Nigro (Padua Univ.), L. Paoluzi, P. Spillantini (CNEN, Frascati, Italy) et al 19 Dec. 1972 21 p refs Submitted for publication
(Nota-Interna-420) Avail: NTIS HC $3.25

Measurements of the total cross sections for the reaction positron electron yeids h(+ or -) H(-) where h is either a pion or a kaon are reported for center-of-mass ranging from 1.2 to 2.4 GeV. Hadronic cross sections for positron electron annihilation were estimated. The experiment was conducted at the Adone electron-positron colliding beam machine, including two spark chamber counter telescopes, and those counters, including two threshold Cerenkov counters, used to distinguish pions from kaons at total energies below 800 MeV. The electromagnetic pion form factor squared was estimated based on values obtained for the ratio sigma kk/sigma P.P. using the vector dominance meson model. It was found that at any rate the estimated values are higher than those predicted by the statistical model. ESRO

N73-27614# Westfield Coll., London (England). Dept. of Physics.
FRAGMENTATION MODELS AND UNITARITY
Michael Teper Jan. 1972 17 p refs Sponsored by UK Sci. Res. Council
Avail: NTIS HC $3.00

The diffractive excitation model is used to evaluate the inelastic part of the proton-proton unitarity equation. Conventional assumptions about the phase of the vacuum singularity, and an experimentally motivated choice of mass dependence for the diffractive slope, lead to an upper bound for the proportion of diffractively excited inelastic processes. The apparent breakdown of factorization is also discussed. Author (ESRO)

N73-27615# Westfield Coll., London (England). Dept. of Physics.
PROTON-ANTIPROTON ANNIHILATIONS: A CRITIQUE OF THE UNCORRELATED JET MODEL
Michael Teper Jan. 1973 43 p refs Sponsored by UK Sci. Res. Council
Avail: NTIS HC $4.25

An attempt is made to understand the differential pp and proton-antiproton elastic cross sections in terms of an annihilation overlap integral, using an uncorrelated jet model. The crucial importance of phases is pointed out, and the overlap integral is evaluated with an appealing choice of phase. The result is inconsistent with experiment. It is concluded that a simple uncorrelated model is unlikely to give a good representation of the annihilation overlap integral. Lessons are drawn for the use of uncorrelated jet models in the evaluation of the proton-proton overlap integral. Author (ESRO)

N73-27616# Westfield Coll., London (England). Dept. of Physics.
NON-DIFFRACTIVE MODELS WITH < n SQUARED > APPROXIMATE 1/S
Michael Teper [1972] 11 p refs Sponsored by UK Sci. Res. Council
Avail: NTIS HC $3.00

A distinctive and much remarked prediction of the diffractive fragmentation model is that < n squared > approximates 1/s. Borrowing the diffractive model's assumptions about the multiplicity of resonance decays, two other dynamical mechanisms are pointed out which yeild the same prediction for < n squared >. Neither mechanism involves a diffractive exchange. Author (ESRO)

N73-27617# Technion - Israel Inst. of Tech., Haifa.
PROPERTIES OF ELECTRON GAS IN CONSTANT MAGNETIC AND ELECTRIC FIELDS Final Technical Report
J. Zak Dec. 1972 16 p refs
(Contract DAJA37-72-C-1915; DA Proj. 2o0-61102-B-31E)
(AD-760587; ARDG(E)-E-1262) Avail: NTIS CSCL 20/12

Three problems are investigated: The impurity problem in semiconductors, the dynamics of electrons in a magnetic field, and the density of states approach to the behavior of electrons in an electric field. A number of general theorems are proven for the impurity problem in semiconductors. It is rigorously shown that a local perturbation of a Bloch Hamiltonian does not affect the band structure, but rather leads to the formation of bound states. These are known as the impurity states, and it is shown that they have no accumulation point in the band gaps. In the case of the electric field the stability of bands is described by means of a spectral density operator. For the magnetic field problem model Hamiltonians are constructed for the investigation of the influence of the rationality of the field on the spectrum and the density of states. (Author Modified Abstract) GRA

N73-27618# Aerospace Corp., El Segundo, Calif.
A CHRONOMETER FOR S-PROCESS NUCLEOSYNTHESIS: Pb-205
J. B. Blake, Typhoon Lee (Texas Univ.), and David N. Schramm (Texas Univ.) 15 May 1973 23 p refs
(Contract F04701-72-C-0073; Grant NSF GP-32051)
(AD-760535; TR-0073(3260-201)-16; SAMSO-TR-73-173)
Avail: NTIS CSCL 20/8

The importance of the short-lived s-process chronometer 205Pb, its relation to the mechanism of s-process nucleosynthesis, and its implication for cosmochronology are discussed.
Author (GRA)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N73-27619 Colorado State Univ., Fort Collins.
STATISTICAL MECHANICS OF PLASMAS Ph.D. Thesis
Shang Hoon Kim 1972 95 p
Avail: Univ. Microfilms Order No. 73-2798

The development of new theoretical foundations for the (1) mathematical description of collisionless plasmas, (2) the statistical dynamics of random plasma continua, (3) the application of these foundations to the evaluation of the spectral energy density of the turbulent electric field in wavenumber space, and (4) the calculation of the broadening of hydrogen-like spectral lines by turbulent electric fields. The last investigation permits determination of the properties of turbulent plasmas from the observed stark broadening of spectral lines. Dissert. Abstr.

N73-27620*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
BOUNDARY-LAYER ELECTRON PROFILES FOR ENTRY OF A BLUNTS SLENDER BODY AT HIGH ALTITUDE
John S. Evans, Charles J. Schexnayder, Jr., and Paul W. Huber Washington Jul. 1973 40 p refs
(NASA-TN-D-7332) Avail: NTIS HC $3.00 CSCL 20I

New calculations of boundary-layer electron concentration profiles for entry of a blunt-nosed slender body into the earth's atmosphere are compared with previous calculations in which ambipolar diffusion was neglected. The old and new results agree in those flight regimes where ambipolar diffusion is unimportant, but large differences are noted in both peak electron concentration and profile shape at the higher altitudes, where diffusion effects are greatest. The new results are also compared with flight-measured profiles and with calculated profiles for a viscous-shock-layer theory which was recently reported in the literature. The boundary-layer results and the data agree in most respects. Differences which occur between predicted results and the data in the outer parts of the profile are discussed in terms of the effects of aerodynamic heating of the probes. Author

N73-27621# Joint Publications Research Service, Arlington, Va.
POSSIBLE MECHANISMS OF TURBULENT HEATING OF A PLASMA BY ULTRASHORT LASER PULSES
S. D. Fanchenko and G. V. Sholin 15 May 1973 6 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 204, no. 5, 1972 p 1090-1093
(JPRS-59027) Avail: NTIS HC $3.00

In experiments to obtain a high temperature dense plasma using picosecond laser pulses, effective heating was observed not only of the electrons but also the ions. Hard X-radiation with an energy appreciably exceeding the electron temperature of the plasma was also detected. The time structure of the laser radiation in these experiments was very complex. Author

N73-27622# Joint Publications Research Service, Arlington, Va.

THEORY OF STREAMER BREAKDOWN

A. I. Zakharov, T. G. Persiantsev, V. D. Pismennyy, A. V. Rodin, and A. N. Starostin 10 Jul. 1973 15 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Teoreticheskoy Fiz. (Moscow), no. 1, 1973 p 56-65

(JPRS-59474) Avail: NTIS HC $3.00

The development of the successive theory of streamer breakdown of a gas requires examination of transport of the zone of ionization in the direction of unionized gas in an electric field, depending on the form of the streamer, which is governed, in turn, by the transport mechanisms. This problem is very complex and the theory proceeds along the path of analysis of various qualitative streamer models. Author

N73-27623*# California Univ., Berkeley.

PLASMA KINETIC THEORY . Final Report

Allan N. Kaufman 7 Jun. 1973 5 p refs

(Grants NGR-05-003-220; NGL-05-003-220)

(NASA-CR-132785) Avail: NTIS HC $3.00 CSCL 20I

Plasma kinetic theory is examined. Data cover nonlinear oscillations and plasma turbulence in uniform and nonuniform media. E.H.W.

N73-27624*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.

ELECTRIC FIELD CORRECTIONS IN THE GUIDANCE-CENTER PLASMA

G. Joyce, D. Montgomery, and M. Emery Apr. 1973 22 p refs

(Grant NGL-16-001-043; Contract AT(11-1)-2059)

(NASA-CR-133410; U-of-Iowa-73-12) Avail: NTIS HC $3.25 CSCL 20I

Electric field autocorrelations for the two-dimensional electrostatic guiding-center plasma are calculated numerically. It is concluded that the autocorrelation, averaged over a thermal equilibrium ensemble, is damped in an approximately exponential fashion, as predicted by Taylor and McNamara. Oscillatory behavior of the type predicted by Taylor and Thompson is not observed. Author

N73-27625# Sydney Univ. (Australia). Wills Plasma Physics Dept.

[PROGRESS IN PLASMA SOURCES, HYDROMAGNETIC SHOCK WAVES, ROTATING PLASMA, ION CYCLOTRONS, CYLOTRON HARMONIC WAVES, FAR INFRARED, AIR POLLUTION, AND LASER DIAGNOSTICS RESEARCH]

Progress Report, 1 Jul. - 31 Dec. 1972

1972 11 p refs

(NP-19681; PR-24) Avail: AEC Depository Libraries

Brief descriptions of research during this period are given for the following topics: (1) plasma sources, (2) hydromagnetic shock waves, (3) rotating plasmas, (4) ion cyclotron work, (5) cyclotron harmonic waves, (6) far-infrared, and (7) laser diagnostics. NSA

N73-27626# Lausanne Univ. (Switzerland). Centre de Recherches en Physique des Plasmas.

SIMULATION OF BELT PINCH EXPERIMENTS INCLUDING THE CIRCUIT EQUATIONS

D. W. Ignat and F. Hofmann Mar. 1973 25 p refs Sponsored by the Swiss Natl. Sci. Found.

(LRP-61/73) Avail: NTIS HC $3.25

An existing 1-D MHD code was modified to compute belt pinch experiments including the interaction between the plasma and the external circuit and self-consistent determination of the field in the toroidal core. Results of a computation simulating the Garching experiment were compared with those of a similar calculation which assumes a sine wave time dependence for the current in the coil. Simulations of the belt pinch presently under construction at this laboratory were executed. Ion temperatures of approximately 200 eV with a 10 m torr D2 filling were computed. Author (ESRO)

N73-27627# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE INFLUENCE OF DISCHARGE PARAMETERS ON THE INTENSITY OF THE 1850 A AND 2537 A MERCURY RESONANCE LINES

F. A. Butaeva and V. A. Fabrikant 30 Apr. 1973 18 p refs Transl. into ENGLISH from Zh. Tekh. Fiz. (Leningrad), v. 18, no. 9, 5 May 1948 p 1127-1135

(AD-760958; FTD-HT-23-353-73) Avail: NTIS CSCL 20/9

Using a vacuum scintillation spectrophotometer the authors investigate the influence of current strength, vapor pressure, and argon pressure on the intensity of the 1850 and 2537 A lines. The intensity of the 1850 A line increases linearly with current, while for the 2537 A line the authors observe noticeable deviations from linearity. The operating conditions of the fluorescent lamps correspond to the maximum intensities of both mercury resonance lines. Author (GRA)

N73-27628# California Univ., Los Angeles. Plasma Physics Group.

STABILIZATION OF ION THRUST ACOUSTIC WAVES BY ELECTRON TRAPPING

Norman W. Albright Apr. 1973 25 p refs

(Contract N00014-69-A-0200-4023; Grant NSF GP-2287)

(AD-761174; PPG-148) Avail: NTIS CSCL 20/9

The authors consider the unstable ion acoustic waves resulting from a beam of electrons entering a plasma. A test wave is considered which was introduced in the region of unstable waves through the same boundary that the beam enters the plasma. This test wave has an amplitude much larger than the noise. The growth rate of this wave including the effects of electron trapping and collisions is calculated. It is found that such a test wave will stabilize by electron trapping. Author (GRA)

N73-27629# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

ANALYSIS OF OPTICALLY THICK, dc INDUCTION HEATED ARC DISCHARGES

Paul W. Schreiber, Allen M. Hunter, II, Paul Taylor, and Kenneth R. Benedetto Apr. 1973 74 p refs

(AF Proj. 7073)

(AD-760808; ARL-73-0073) Avail: NTIS CSCL 20/9

An analytical study was made to determine the properties of arc discharges heated by combinations of induction and dc electromagnetic fields. Induction power is supplied to the discharge by a solenoidal coil whose axis of symmetry is aligned with the applied dc electric field. A numerical technique is used to simultaneously solve a set of linear differential equations which include Maxwell's field equations, the single fluid energy equation, the momentum balance equation, Ohm's law, and the radiation diffusion equation. A number of reasonable assumptions are made to obtain the final set of equations for programming. These assumptions restrict the calculations to azimuthally symmetric plasmas with axial gradients only in static pressure. In addition, the radiant energy flux is assumed to be isotropic within the plasma. (Author Modified Abstract) GRA

N73-27630# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STATIC CHARACTERISTICS OF ELECTROHYDRODYNAMIC INVERTED CONVERTERS

V. S. Nagornyi 10 May 1973 13 p refs Transl. into ENGLISH from Priborostroenie (USSR), no. 12, 1972 p 19-23

(AD-760966; FTD-HT-23-412-73) Avail: NTIS CSCL 20/9

The practical benefits derived from the development of an electrohydrodynamic inverted converter, using spindle oil as the working fluid, are described. The use of oil as the working fluid in place of mercury became possible as the result of applying a completely different physical principle for shifting the working fluid under the action of the input electric signal. Experiments conducted showed that in the case of the direct application of an electrostatic field to commercially pure spindle oil a partial displacement of the liquid is observed as a result of the action of ponderomotive forces. The liquid fills only part of the space

between the electrodes, and in essence there is a two-phase liquid-gas dielectric found in the field of the condenser. Analytical expressions describing the process are given. D.L.G.

N73-27631# California Univ., Los Angeles. Plasma Physics Group.
SPATIAL GROWTH PROPERTIES OF PARAMETRIC AND BACKSCATTERING PLASMA INSTABILITIES
Burton D. Fried, George Schmidt, and Roy M. Gould (Calif. Inst. of Tech., Pasadena) Apr. 1973 19 p refs
(Contracts N00014-69-A-0200-4023; AT(04-3)-34)
(AD-761173; PPG-146) Avail: NTIS CSCL 20/9

Simple general arguments are used to show that for instabilities resulting from the coupling of two weakly damped linear modes with oppositely directed group velocities, such as the various parametric instabilities, there exists a range of coupling strengths (pump power in the parametric case) for which the instability is convective; above this range the system is absolutely unstable. The ratio of absolute and convective instability thresholds is large whenever the damping lengths of the linear uncoupled modes have very disparate values.
Author (GRA)

N73-27632# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF FLOW OF PARTIALLY IONIZED ARGON IN HYPERSONIC NOZZLES
G. I. Kozlov, D. I. Roitenburg, V. N. Zimakov, and E. L. Stupitskii 30 Apr. 1973 14 p refs Transl. into ENGLISH from the publ. "Teplofizicheskive Svovstva Nizkotemperaturnoy Plazmy" USSR, 1970 p 129-132
(AD-760967; FTD-HT-23-370-73) Avail: NTIS CSCL 20/9

The theoretical and experimental investigation of the one dimensional flow of partially ionized argon in a hypersonic nozzle is reported. Author (GRA)

N73-27633# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
PARAMETRIC EXCITATION OF ION-ACOUSTIC WAVES IN A FULLY IONIZED, BOUNDED PLASMA
Takeru Ohe, Richard H. Abrams, Jr., and Herbert Lashinsky Apr. 1973 39 p refs
(Grant AF-AFOSR-2179-72; AF Proj. 9783)
(AD-760794; BN-765; AFOSR-73-0914TR) Avail: NTIS CSCL 20/9

Parametric excitation of ion-acoustic waves in the fully ionized bounded plasma in a Q-machine is demonstrated by periodic variation of the electron temperature. The electron temperature is controlled by nonresonant radio-frequency heating, the periodic variation of the electron temperature being achieved by amplitude modulation of the rf power. A model based on the ion-acoustic wave equation for the bounded geometry and the Mathieu equation with appropriate nonlinear terms is found to be in agreement with experimental results such as growth rates, amplitude saturation, phase effects, threshold values, and symmetry properties of the resonance curves. Author (GRA)

N73-27634# Stanford Univ., Calif. Dept. of Mechanical Engineering.
NONEQUILIBRIUM PHENOMENA IN FLOWING PLASMAS Final Scientific Report
R. H. Eustics, C. H. Kruger, and M. Mitchner Mar. 1973 18 p refs
(Contract F44620-68-C-0051; AF Proj. 9752)
(AD-760792; AFOSR-73-0867TR) Avail: NTIS CSCL 20/9

Summarized is the research on transport coefficients in partially ionized two-temperature plasmas, the effects of nonelastic collisions on the kinetic theory of high temperature gases, ionization rates including nonelastic collision effects, the nonequilibrium boundary layer in flowing plasmas, vibrational interactions in rapidly expanding gases, stability and breakdown phenomena in plasmas flowing through magnetic fields, current distributions and discharge characteristics, and diagnostic techniques. The work is summarized under four broad categories: MHD generator related experiments, properties of nonequilibrium collision dominated plasmas, diagnostics, and nonequilibrium measurements in rapidly expanded flows. GRA

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N73-27635 National Lending Library for Science and Technology, Boston Spa (England).
THE EFFECTS OF INTERNAL beta-RADIATION ON THE ELECTRICAL CONDUCTIVITY OF MICA
R. M. Gold, V. A. Chernyshev, and V. I. Podpletev Feb. 1973 5 p refs Transl. into ENGLISH from Tr. Mezhvuz. Konf. Radiats Fiz. Tomsk, Jun. 1967 (Tomsk), 1970 p 271-273
(NLL-RTS-7926) Avail: Natl. Lending Library, Boston Spa, Engl.: 4Op; 1 NLL photocopy coupon

Results of measurements confirm the suggestion that the changes which occur in the electrical conductivities of potassium-bearing minerals with age are due to internal beta radiation, resulting from K-40 decay. The reduction of the electrical conductivity of mica, in its natural conductivity region, by the action of radiation, suggests the possibility of developing radiation techniques for improving the quality of inorganic dielectric materials for use in industry. Author

N73-27636 Stanford Univ., Calif.
SPECIFIC HEAT OF SOME UNUSUAL SUPERCONDUCTORS Ph.D. Thesis
Christopher Nelson King 1972 116 p
Avail: Univ. Microfilms Order No. 73-4532

Techniques for measuring the low temperature heat capacity of samples as small as one milligram have been developed. The calorimeter design and mathematical solutions of the heat flow equations for the experimental configuration are presented. The superconducting properties of the hexagonal rubidium tungsten bronze have been investigated with specific heat measurements on single crystals from 1.5 to 40 deg Kelvin. The specific heat of rubidium tungsten bronze shows a large excess heat capacity over the expected electronic and Debye terms. Measurements were taken from the heat capacity of small grain-sized (granular) aluminum films from 1.5 to 8 deg Kelvin. The data show the film to have an enhanced, bulk superconducting transition of 2 deg Kelvin. Dissert. Abstr.

N73-27637 Brown Univ., Providence, R.I.
PIEZOBIREFRINGENCE OF AMORPHOUS AND CRYSTALLINE SEMICONDUCTORS WITH THE ZINCBLENDE, WURTZITE AND ROCKSALT STRUCTURES Ph.D. Thesis
Peter Yound Yu 1972 289 p
Avail: Univ. Microfilms Order No. 73-2357

The photoelastic properties of amorphous and crystalline semiconductors have been studied by measuring their stress-induced birefringence. The amorphous semiconductor studied is amorphous Se. The crystalline semiconductors studied are the zincblende-type III-V compounds (GaSb, InAs and InSb), II-VI compounds (ZnS, ZnSe, ZnTe and CdTe), the wurtzite-type II-VI compounds (CdS and ZnO) and the rocksalt-type IV-VI compounds (PbS and PbTe). Theoretical models involving parabolic bands are proposed to explain the important features in the PB coefficients of the crystalline semiconductors, such as their sign and wavelength dependence. Effects of excitonic interaction, hexagonal crystal field and exchange are included.
Dissert. Abstr.

N73-27638 Wisconsin Univ., Madison.
PERTURBED ANGULAR CORRELATION STUDIES OF RARE EARTH NUCLEI IMPLANTED INTO CUBIC METALS Ph.D. Thesis
Dennis William Gebbie 1972 172 p
Avail: Univ. Microfilms Order No. 72-28487

The ion implantation perturbed angular correlation technique has been used in both the integral and time differential mode to study the large attenuations that occur when rare earth nuclei are implanted into simple metals. A 25 MeV O-14 beam from the University of Wisconsin tandem accelerator was used to Coulomb excite the rare earth nuclei Sm-154, Dy-162 Er-170 and Yb-174 and to implant them into the cubic metals of Al, Cu, Rh and Ag. The observed attenuation as a function of

temperature have been interpreted in the Abragam and Pound formalism as due to a predominantly time dependent magnetic interaction caused by a fluctuating 4f shell of the ion.
Dissert. Abstr.

N73-27639 South Carolina Univ., Columbia.
THE ELECTRICAL PROPERTIES OF SILICON UNDER DYNAMIC LOADING Ph.D. Thesis
Larry Wayne Craver 1972 240 p
Avail: Univ. Microfilms Order No. 73-3593

The electrical properties of silicon under uniaxial stress were determined and related to various theories. The piezoresistivity and Hall effect for n-type silicon when stress is applied in the /111/ direction were determined by laboratory measurements and the results of investigation by others. Laboratory measurements included dynamic loading using the split-Hopkinson bar method, static loading, and temperature effects. The results of investigation by others included both dynamic and static loading. The theories studied were based (for the most part) on a mathematical derivation for the Hall effect. First a model was derived for silicon, using the multi-valley energy approach, without consideration for stress. Then the effect of axis shift under stress was applied to this model in detail. Also the effect of a change in the anisotropic constant was based upon this model.
Dissert. Abstr.

N73-27640 City Univ. of New York.
TUNNELING IN METAL-SEMICONDUCTOR JUNCTIONS Ph.D. Thesis
George Joseph Forest 1972 156 p
Avail: Univ. Microfilms Order No. 73-2836

The dynamic conductance and its derivative were measured as a function of D.C. bias for metal-silicon and metal-germanium junctions. The theory of Davis and Steinrisser was tested for phonon-assisted inelastic tunneling in n-Ge by varying the impurity concentration and measuring the relative strength of the inelastic tunneling due to the TA, LA, LO and TO phonons. This theory was found to be inadequate to explain our results. Electron self energy effects due to the k=0 optical phonon were observed. The strength of these effects was measured as a function of carrier concentration. This phenomenon had been previously observed in various semiconductors but not in n-Ge. We have measured the tunneling characteristics for tunneling into the Gamma sub 2 prime state in Ge. Landau levels due to an applied magnetic field of up to 60 Kg were observed. This type of measurement had not been previously done in metal-semiconductor contacts of n-Ge. The results indicate differences between these contacts and p-n junctions where these measurements have been made. Dissert. Abstr.

N73-27641 Tennessee Univ., Knoxville.
THE NICKEL-61 MOSSBAUER EFFECT IN NICKEL-PALLADIUM ALLOYS Ph.D. Thesis
John Emerson Tansil 1972 86 p
Avail: Univ. Microfilms Order No. 73-2502

The 67.4 keV transition from Ni-61 was used to obtain Mossbauer absorption spectra with Ni-Pd alloy absorbers throughout the concentration range 0 to 99.5 at. % Pd. The source contained the parent isotope Co-61 produced by the reaction Ni-64(p, alpha)Co-61, in a nonmagnetic Ni-64-V (14 at. %) foil. Both source and absorber were immersed in liquid He. In the ferromagnetic region 0 to 98 at. % Pd the spectra showed a partly resolved magnetic hyperfine splitting with a distribution of magnetic hyperfine fields. For each absorber a value was obtained for the Ni-61 recoilless fraction, energy shift, absolute value of the hyperfine field, and second moment of the magnetic field distribution. The Ni-61 average hyperfine field is negative in pure Ni(-76 kOe), changes sign near 50 at. % Pd, and rises to a large positive value (+173 kOe) at 90 at. % Pd. Qualitative agreement with these results is obtained using a model.
Dissert. Abstr.

N73-27642 Stanford Univ., Calif.
HIGH TEMPERATURE DISLOCATION MOBILITY IN LiF Ph.D. Thesis
Ricardo Augusto do Amaral Menezes 1972 167 p
Avail: Univ. Microfilms Order No. 73-4558

The mobilities of dislocations in lithium fluoride single crystals were studied at high temperatures (0.7 to 0.8 Tm). The study divides into two interrelated parts: (1) the indirect measurement of dislocation velocities and (2) the theoretical formulation of a model for interpreting the measured velocities. In the first part, dislocation glide velocities in LiF are determined by the study of the high temperature/low stress creep behavior of low dislocation density crystals. The creep behavior is found to be sigmoidal in character and to conform to the dislocation multiplication model of creep developed by Haasen and co-workers for covalent crystals. In the second part, a model for the glide velocity in ionic crystals is formulated and its predictions are compared with the velocity data obtained in LiF. It is concluded that the glide process in LiF at high temperatures is controlled by the duffusional drag of space-charge clouds. Dissert. Abstr.

N73-27643 Iowa State Univ. of Science and Technology, Ames.
A THEORETICAL TREATMENT OF THE SCHWARZ-HORA EFFECT Ph.D. Thesis
George Ronald Hadley 1972 55 p
Avail: Univ. Microfilms Order No. 73-3888

In the Schwarz-Hora effect, an electron beam passing through a crystal is modulated by laser light and then reproduces the light when it strikes a nonluminescent target. The theory for the modulation process is developed for incident plane wave electrons using the Born approximation to second order. A wave packet treatment of the incident electrons is also included to study interparticle phasing. Finally, light production at a non-resonant target is discussed classically and quantum mechanically, and an upper limit for the amount of light emitted at the laser frequency is calculated using a semi-classical model.
Dissert. Abstr.

N73-27644 Brown Univ., Providence, R.I.
HIGH FREQUENCY TRANSPORT COEFFICIENTS OF A CLEAN TYPE 2 SUPERCONDUCTOR NEAR THE UPPER CRITICAL FIELD Ph.D. Thesis
Hilda Alicia Gomez de Cerdeira 1972 116 p
Avail: Univ. Microfilms Order No. 73-2241

The attenuation is examined of high frequency longitudinal sound and the electrical conductivity in clean type II superconductors near the upper critical field. The approach used is a generalization of that used by Brandt, Pesch and Tewordt to calculate the density of states of a pure type 2 superconductor. It is shown that both the attenuation of sound and the electrical conductivity are strongly dependent on mean free path. In the low temperature limit, simple functional relationships are obtained between the transport coefficients, mean free path and magnetic field. Dissert. Abstr.

N73-27645 Brown Univ., Providence, R.I.
TWO CONTRIBUTIONS TO THE THEORY OF METASTABLE STATES IN SUPERCONDUCTIVITY Ph.D. Thesis
Henwell Huei-you Chou 1972 148 p
Avail: Univ. Microfilms Order No. 73-2249

A two part study is presented on the characteristics of metastable states of superconductors in the presence of magnetic fields and their treatment with appropriate generalizations of the Ginzburg-Landau theory. In the first part, the leading terms in the temperature dependence of the superheating critical field ratio in the nearly local region were determined. The higher order nonlinear terms in the generalized Ginzburg-Landau theory and the effective boundary conditions due to surface effects are included. In the second part, resistive fluctuations between metastable quantum states which occur close to Tc in a hollow superconducting cylinder of radius r whose thickness d is small compared to r, Lambda, and Xi (T) are considered.
Dissert. Abstr.

N73-27646 Brown Univ., Providence, R.I.
MICROWAVE SURFACE IMPEDANCE STUDIES OF BERYLLIUM Ph.D. Thesis
Thomas Albert Kennedy 1972 118 p
Avail: Univ. Microfilms Order No. 73-2295

Three studies were made of electronic properties of single crystal beryllium: conduction electron spin resonance, Azbel'-Kaner cyclotron resonance, and magnetic surface levels. The experiments involved measurements of the surface impedance at microwave

frequencies. The conduction electron spin resonance (CESR) study was done on two samples of different purities and from different sources. The temperature dependence of the amplitude of the CESR was measured in the range from 295 to 150K. At these temperatures for the samples used, the skin effect is classical, the spin-lattice relaxation time T1 is nearly constant, and the skin depth is less than the spin diffusion distance. For these conditions the Dyson theory predicts that the signal strength is proportional to the resistivity to the 3/2 power. The experimental results are in semi-quantitative agreement with the 3/2 power dependence. Lineshape parameters for the sample with narrower room-temperature line-width were measured at 35 GHz for temperatures from 350 to 77K. A sharp broadening in the linewidth. Dissert. Abstr.

N73-27647 Brown Univ., Providence, R.I.
THE INTERACTION OF HEAT PULSES AND OF ULTRASONIC WAVES WITH STRESS-SPLIT ACCEPTOR STATES IN SEMICONDUCTORS Ph.D. Thesis
Tor Arne Fjeldly 1972 133 p
Avail: Univ. Microfilms Order No. 73-2260

The existence of interactions of heat pulses (thermal phonons) and of ultrasonic waves with stress-split acceptor impurity states in semiconductors was demonstrated. These interactions were measured systematically at low temperatures. In the heat pulse experiments the unscattered (ballistic) energy of these pulses was measured after their propagation through the bulk of the samples used, as a function of applied uniaxial stress. These experiments were performed on a number of samples of boron-doped Si and gallium-doped Ge. For the various samples used the stress dependence was measured at several levels of power dissipation in the heat pulse generator (i.e., for several pulse temperatures). The amplitude (pulse energy) vs. stress relations obtained were characterized by a minimum in the detected pulse energy. In Si, this minimum was found to shift towards higher stresses with increasing pulse temperature. Dissert. Abstr.

N73-27648 Rhode Island Univ., Kingston.
SYNTHESIS AND CHARACTERIZATION OF DIAMOND AND BORON PHOSPHIDE Ph.D. Thesis
K. P. Ananthanarayanan 1972 139 p
Avail: Univ. Microfilms Order No. 73-2370

Semiconducting diamond was synthesized from carbon-metal melts in a 600 ton tetrahedral anvil press at about 60 kbar and 1400 C. The experimental set up, pressure and temperature calibrations, and the growth region in the pressure-temperature regime are indicated. Micrographs of synthezied crystals are shown. The semiconducting properties of diamond, doped with boron, aluminum and titanium were interpreted using the log R versus 1/T curves. Boron phosphide was synthesized from the elements at pressures and temperatures above 20 kbar and 1200 C. The crystal growth rate was determined as a function of temperature and pressure from which an activation energy for the process is derived. Optical and scanning electron micrographs of the crystals synthesized revealed a poorly developed morphology with voids present under all conditions of pressure and temperature. Dissert. Abstr.

N73-27649 Rutgers Univ., New Brunswick, N.J.
THE ELECTRICAL, OPTICAL, AND STRUCTURAL PROPERTIES OF RF TRIODE-SPUTTERED GOLD FILMS Ph.D. Thesis
Roy Harold Cornely 1972 352 p
Avail: Univ. Microfilms Order No. 73-4732

The experimental results were obtained on three sets of gold films, each set consisting of about 17 films with nominal film thickness (N F T) in the 12 to 1000 A range. The film sets were deposited on an amorphous SiO2 substrate in single pumpdowns by RF triode-sputtering in 1.0 mtorr Argon using a moving substrate mechanical fixture. The deposition rate was about 2 A/sec. and the RF sputtering voltage about 2.5 kV. The optical properties of the triode-sputtered films were studied by measuring the reflectance and transmission of films, with N F T from 20 to 960 A, over an incident wavelength range from 0.18 to 2.0 micrometers. Films with N F T less than 50 A were found to behave according to the Maxwell Garnett theory. The optical properties of uniformly thick films were studied by calculating the optical indices for films with N F T from 120 to 240 A, using classical formulas for reflectance and transmission. Dissert. Abstr.

N73-27650# Joint Publications Research Service, Arlington, Va.
GROWTH AND STRUCTURE OF MONOCRYSTALLINE SEMICONDUCTOR FILMS: WORK OF THE SYMPOSIUM, PART 2
L. N. Aleksandrov, ed. 14 Jun. 1973 160 p refs Transl. into ENGLISH of the book "Protsessy Rosta i Struktura Monokristallicheskikh Sloyev Poluprovodnikov: Trudy Simpoziuma, Chast 2" Novosibirsk, Nauka Press, 1969 197 p (JPRS-59279-Pt-2) Avail: NTIS HC $10.00

The characteristic features and possible mechanisms of growth of thin film epitaxial layers from the gas phase are reported. Problems of alloying and autoalloying and the structure and state of the epitaxial surface of monocrystallinie films are discussed. For individual titles, see N73-27651 through N73-27675.

N73-27651 Joint Publications Research Service, Arlington, Va.
THERMODYNAMIC STUDY OF THE GROWTH RATE OF EPITAXIAL SILICON FROM SiCl4
I. B. Sladkov and V. V. Tuchkevich *In its* Growth and Struct. of Monocrystalline Semicond. Films (JRRS-59279-Pt-2) 14 Jun. 1973 p 2-7 refs Transl. into ENGLISH from the book "Protsessy Rosta i Struktura Monokristallicheskikh Sloyev Poluprovodnikov: Trudy Simpoziuma, Chast 2" Novosibirsk, Nauka Press, 1969 p 7-14 (For availability see N73-27650 18-26)

An effort was made to explain the experimental relations of the growth rate of epitaxial silicon films grown by reducing the silicon tetrachloride by hydrogen in the vertical reactor on the basis of the model of keeping the chemical equilibrium in the reaction zone. Author

N73-27652 Joint Publications Research Service, Arlington, Va.
RELATION BETWEEN THE DEPOSITION CONDITIONS AND THE VOLT-AMPERE CHARACTERISTICS OF EPITAXIAL p-n JUNCTIONS
I. B. Sladkov, V. V. Tuchkevich, and B. S. Yavich *In its* Growth and Struct. of Monocrystalline Semicond. Films (JPRS-59279-Pt-2) 14 Jun. 1973 p 8-13 refs Transl. into ENGLISH from the book "Protsessy Rosta i Struktura Monokristallicheskikh Sloyev Poluprovodnikov: Trudy Simpoziuma, Chast 2" Novosibirsk, Nauka Press, 1969 p 15-21 (For availability see N73-27650 18-26)

A study was made of the deposition factors affecting the morphology and the resistance of the epitaxial layers of silicon obtained by reducing the silicon tetrachloride by hydrogen. The inverse volt ampere characteristics of the p-n-junctions are presented. Author

N73-27653 Joint Publications Research Service, Arlington, Va.
MECHANISM OF AUTOEPITAXY OF SILICON FOR GROWTH FROM THE VAPOR-GAS MIXTURE (SiCl4 PLUS H2 PLUS Z PRIME Cl3) IN THE OPEN PROCESS
Yu. D. Chistyakov, A. Yu. Malinin, and V. M. Biryukov *In its* Growth and Struct. of Monocrystalline Semicond. Films JPRS)-59279-Pt-2) 14 Jun. 1973 p 14-23 refs Transl. into ENGLISH from the book "Protsessy Rosta i Struktura Monokristallicheskikh Sloyev Poluprovodnikov: Trudov Simpoziuma, Chast 2" Novosibirsk, Nauka Press, 1969 p 22-32 (For availability see N73-27650 18-26)
Avail: NTIS

Experimental confirmation, for the hypothetical vapor-liquid-epitaxial layer mechanism of autoepitaxy of silicon during the process of reducing the silicon from the vapor-gas layer of its tetrachloride with hydrogen and alloying additives, is found. It was proposed that the thin layer is formed on the silicon surface in accordance with a phase equilibrium diagram in the Si-O-Z prime-Z double prime system. The autoepitaxial layers of silicon obtained from the vapor-gas mixture in the open process owe their high degree of geometric and structural perfection and also the uniformity of composition and electrophysical properties to growth by the vapor-liquid-epitaxial layer mechanism. Author

N73-27654 Joint Publications Research Service, Arlington, Va.
UTILIZATION OF THE SANDWICH METHOD TO OBTAIN EPITAXIAL LAYERS OF SEMICONDUCTING MATERIALS
A. S. Korotkov, Yu. D. Chistyakov, and Yu. N. Tikhonov *In its* Growth and Struct. of Monocrystalline Semicond. Films (JPRS-59279-Pt-2) 14 Jun. 1973 p 24-31 refs Transl. into ENGLISH from the book "Protsessy Rosta i Struktura Monokristallicheskikh Sloyev Poluprovodnikov: Trudy Simpozium, Chast 2" Novosibirsk, Nauka Press, 1969 p 33-41 (For availability see N73-27650 18-26)

A study was made of obtaining autoepitaxial layers of Si, GaAs and also heteroepitaxial layers of GaAs-Ge using the Sandwich method. As the transport agent for transporting the silicon, SiCl4 vapor was used and for the GaAs transport, the H2O + H2 system was used. The thermodynamic and kinetic analysis of the reactions demonstrated the significant lack of correspondence of the calculated and experimental values. In order to explain this and a number of other anomalous phenomena noted during the autoepitaxy, a mechanism was proposed taking into account the nature of the physical-chemical interaction of the substrate with the environment and assuming the presence of a liquid phase of defined composition on the surface of the plates. Author

N73-27655 Joint Publications Research Service, Arlington, Va.
MECHANISM OF SILICON AUTOEPITAXY DURING TRANSPORT IN SMALL INTERVALS
Yu. D. Christyakov and A. S. Korotkov *In its* Growth and Struct. of Monocrystalline Semicond. Films (JPRS-59279-Pt-2) 14 Jun. 1973 p 32-40 refs Transl. into ENGLISH from the book "Protsessy Rosta i Struktura Monokristallicheskikh Sloyev Poluprovodnikov: Trudy Simpoziuma, Chast 2" Novosibirsk, Nauka Press, 1969 p 42-51 (For availability see N73-27650 18-26)
Avail: NTIS

An analysis was made of the development and transport of autoepitaxial layers in the sandwich process with the presence of a liquid phase layer. E.H.W.

N73-27656 Joint Publications Research Service, Arlington, Va.
OBTAINING EPITAXIAL LAYERS OF GERMANIUM AND SILICON BY THE CHLORIDE METHOD AT REDUCED TEMPERATURES
E. O. Tizenberg, A. Ya. Odzinya, I. I. Vevere, and Ya. A. Naglis *In its* Growth and Struct. of Monocrystalline Semicond. Films (JPRS-59279-Pt-2) 14 Jun. 1973 p 41-44 refs Transl. into ENGLISH from the book "Protsessy Rosta i Struktura Monokristallicheskikh Sloyev Poluprovodnikov: Trudy Simpoziuma, Chast 2" Novosibirsk, Nauka Press, 1969 p 52-56 (For availability see N73-27650 18-26)

The conditions necessary for obtaining high quality epitaxial layers of Ge and Si at low temperatures are investigated. Structural perfections, growth rate, and specific resistance as a function of temperature are also examined. E.H.W.

N73-27657 Joint Publications Research Service, Arlington, Va.
GROWTH OF EPITAXIAL SILICON FILMS WITH THE APPLICATION OF HYDROGEN OF HIGH PURITY AND THE STUDY OF THEIR PROPERTIES
V. P. Pashkudenko, A. S. Lyutovich, V. M. Mikhaelyan, I. N. Poznyakov, and Ye. I. Morkovkin *In its* Growth and Struct. of Monocrystalline Semicond. Films (JPRS-59279-Pt-2) 14 Jun. 1973 p 45-49 refs Transl. into ENGLISH from the book "Protsessy Rosta i Struktura Monokristallicheskikh Sloyev Poluprovodnikov: Trudy Simpoziuma, Chast 2" Novosibirsk, Nauka Press, 1969 p 57-61 (For availability see N73-27650 18-26)

Comparative experiments for obtaining epitaxial silicon films of high purity are reported. The specific resistance, effect of water vapor, and the effect of oxygen on the film are discussed. F.O.S.

N73-27658 Joint Publications Research Service, Arlington, Va.
STUDY OF THE GROWTH CONDITIONS AND PROPERTIES OF SILICON FILMS DEPOSITED BY THE CHLORIDE METHOD
Z. I. Kiryashkina, D. I. Bilenko, V. K. Demidov, N. G. Galishnikova, N. G. Zykova, L. D. Zorina, and V. N. Tenkayeva *In its* Growth and Struct. of Monocrystalline Semicond. Films (JPRS-59279-Pt-2) 14 Jun. 1973 p 50-55 refs Transl. into ENGLISH from the book "Protsessy Rosta i Struktura Monokristallicheskikh Sloyev Poluprovodnikov: Trudy Simpoziuma, Chast 2" Novosibirsk, Nauka Press, 1969 p 62-68 (For availability see N73-27650 18-26)

The effect of growth conditions on the electrophysical properties of polycrystalline film were studied. The specific resistance, morphology, and mobility of the charge carriers are discussed along with the effects of deposition temperature and vapor concentration. F.O.S.

N73-27659 Joint Publications Research Service, Arlington, Va.
STUDIES OF THE TRANSPORT OF CERTAIN DONOR AND ACCEPTOR ADMIXTURES FOR EPITAXIAL GROWTH OF SILICON BY THE SANDWICH METHOD
B. G. Anokhin, E. M. Zhurkina, G. F. Lymar, and A. N. Nelyubova *In its* Growth and Struct. of Monocrystalline Semicond. Films (JPRS-59279-Pt-2) 14 Jun. 1973 p 56-64 refs Transl. into ENGLISH from the book "Protsessy Rosta i Struktura Monokristallicheskikh Sloyev Poluprovodnikov: Trudy Simpoziuma, Chast 2" Novosibirsk, Nauka Press, 1969 p 69-78 (For availability see N73-27650 18-26)

The transport coefficients were determined for mixtures of P, As, Sb, B, In, Ga, and Al. The redistribution between the films of these mixtures and the substrates were studied along with the autoalloying that occurrs when growing epitaxial layers of silicon by the sandwich method. It is concluded that to obtain structures with p-n-junctions by the sandwich method, it is necessary to use substrates with In, Al, and Ga, and to avoid the transport of the substrate impurities into the weakly alloyed source, it is necessary to exclude the preliminary heat treatment. F.O.S.

N73-27660 Joint Publications Research Service, Arlington, Va.
ALLOYING EPITAXIAL LAYERS OF SILICON WITH BORON AND ARSENIC USING GAS DISCHARGE
T. A. Dutkina, G. F. Lymar, V. V. Nikolayeva, and I. M. Skvortsov *In its* Growth and Struct. of Monocrystalline Semicond. Films (JPRS-59279-Pt-2) 14 Jun. 1973 p 65-69 ref Transl. into ENGLISH from the book "Protsessy Rosta i Struktura Monokristallicheskikh Sloyev Poluprovodnikov: Trudy Simpoziuma, Chast 2" Novosibirsk, Nauka Press, 1969 p 79-84 (For availability see N73-27650 18-26)

The problem of controlling the alloying of epitaxial silicon films during growth was studied using a gas discharge with arsenic as the donor, and boron as the acceptor impurities. The alloying level of the epitaxial layer is discussed as a function of the current through the discharge. F.O.S.

N73-27661 Joint Publications Research Service, Arlington, Va.
OBTAINING EPITAXIAL SILICON FILMS WITH THE APPLICATION OF HYDROGEN OF HIGH PURITY AND STUDYING THE ADMIXTURE DISTRIBUTION PROFILE
Yu. A. Raynov, A. L. Shimalinkina, A. S. Lyutovich, V. P. Prutkin, V. V. Kharchenko, and E. Khodzhakhamedov *In its* Growth and Struct. of Monocrystalline Semicond. Films (JPRS-59279-Pt-2) 14 Jun. 1973 p 70-77 refs Transl. into ENGLISH from the book "Protsessy Rosta i Struktura Monokristallicheskikh Sloyev Poluprovodnikov: Trudy Simpoziuma, Chast 2" Novosibirsk, Nauka Press, 1969 p 85-92 (For availability see N73-27650 18-26)

The distribution profile of the admixtures in the epitaxial silicon layers is discussed along with the preparation of the films using hydrogen of extreme purity. The distribution in the epitaxial layers in the film substrate systems was studied by neutron activation, and the structure of phosphorus and antimony distribution are analyzed. F.O.S.

N73-27662 Joint Publications Research Service, Arlington, Va.
MECHANISM OF THE DISAPPEARANCE OF PACKING DEFECTS IN SILICON EPITAXIAL FILMS DURING CERTAIN THERMAL PROCESSES
R. A. Kovalev, B. I. Kozlov, and Yu. I. Pashintsev *In its* Growth and Struct. of Monocrystalline Semicond. Films (JPRS-59279 Pt-2) 14 Jun. 1973 p 78-80 refs Transl. into ENGLISH from the book "Protsessy Rosta i Struktura Monokristallicheskikh Sloyev Poluprovodnikov: Trudy Simpoziuma, Chast

2" Novosibirsk, Nauka Press, 1969 p 93-96 (For availability see N73-27650 18-26)

An experiment was conducted to investigate the disappearance of packing defects during thermal oxidation of silicon epitaxial films in wet oxgen. The specimens used in the experiment were silicon epitaxial films of n-type conductivity alloyed with phosphorus. The films were oriented in the (111) plane and oxidized for one hour at a temperature of 1200 C. The results obtained indicate the following: (1) The local stresses arising during oxidation cause splitting of the apex dislocations with the Burguer vector 1/6 <110> into a pair of Heidenreich-Shockley dislocations, with Burguer vectors 1/6 <211>, lying in the planes of the faces of the tetrahedron and axes parallel to the two remaining dislocation apexes. (2) The dislocations formed can glide, destroying the packing defects. (3) When the Heidenreich-Shockley dislocations reach the unsplit dislocation apexes, complete disappearance of the packing defects in the two faces of the tetrahedron takes place. D.L.G.

N73-27663 Joint Publications Research Service, Arlington, Va.
NATURE OF SMOKY SPOTS OCCURRING ON THE SURFACE OF SILICON ALLOYED WITH BORON AFTER CHEMICAL POLISHING
E. G. Azhazha *In its* Growth and Struct. of Monocrystalline Semicond. Films (JPRS-59279-Pt-2) 14 Jun. 1973 p 81-85 refs Transl. into ENGLISH from the book "Protsessy Rosta i Struktura Monokristallicheskikh Sloyev Poluprovodnikov: Trudy Simpoziuma, Chast 2" Novosibirsk, Nauka Press, 1969 p 81-85 (For availability see N73-27650 18-26)
Avail: NTIS

Experiments were conducted to determine the cause and prevention of the smoky spots occurring on the silicon alloy surfaces. The results of the experiments include the following: (1) The occurrence of spots is connected with the presence and concentration of alloying additives of boron in silicon and the difference in mechanism and rate of solution of these elements or compounds of them in the etching agent. (2) Prevention of the spots can be attained by the application of fresh acids, performance of the pickling at a temperature below 21 C, fast halting of the pickling, and increasing the volumetric proportion of nitric acid in the etching agent. D.L.G.

N73-27664 Joint Publications Research Service, Arlington, Va.
KINETICS OF GAS PICKLING AND EPITAXIAL GROWTH OF SEMICONDUCTOR MATERIALS
L. A. Laukmanis and I. A. Feltyn *In its* Growth and Struct. of Monocrystalline Semicond. Films (JPRS-59279-Pt-2) 14 Jun. 1973 p 86-90 refs Transl. into ENGLISH from the book "Protsessy Rosta i Struktura Monokristallicheskikh Sloyev Poluprovodnikov: Trudy Simpoziuma, Chast 2" Novosibirsk, Nauka Press, 1969 p 103-109 (For availability see N73-27650 18-26)

A literature survey revealed that some authors explain the kinetics of the growth process and the gas etching on the basis of the kinetics of chemical reactions, and others explain it on the basis of the diffusion phenomena of the products of the gas phase. A study was then conducted to determine under what conditions the rate of the specific heterogeneous process is governed by the chemical reaction kinetics, and under what conditions by the diffusion of the components of the gas phase. The equation describing the kinetics was solved considering the joint diffusion of the reagent and the reaction products through the boundary layer at the surface of the solid state. The results of the solution are presented in the form of a family of curves demonstrating the dependence of the process rate on the time with equal relations of the work constants of the reactions and the diffusion coefficients. A comparison of the curves indicate that only at temperatures above 850 C does the joint diffusion of the gas phase components become the decisive factor on the process kinetics. D.L.G.

N73-27665 Joint Publications Research Service, Arlington, Va.
VARIATION OF THE ELECTROPHYSICAL PARAMETERS OF EPITAXIAL FILMS OF GERMANIUM AS A RESULT OF GAS ETCHING
E. E. Aboltyn, L. A. Laukmanis, and I. A. Feltyn *In its* Growth and Struct. of Monocrystalline Semicond. Films (JPRS-59279-Pt-2) 14 Jun. 1973 p 91-96 refs Transl. into ENGLISH from the book "Protsessy Rosta i Struktura Monokristallicheskikh Sloyev Poluprovodnikov: Trudy Simpoziuma, Chast 2" Novosibirsk, Nauka Press, 1969 p 110-115 (For availability see N73-27650 18-26)

The results are presented of studies to determine the effect of the gas media on the electrophysical properties by measuring the mean specific resistances, the type of conductivity, the lifetime of the minority carriers, and surface morphology. The findings include the following: (1) The type of conductivity of the epitaxial films does not change as a result of gas etching. (2) The specific resistance of low-resistance epitaxial films increases. (3) The gas media has no effect on the electrical properties of films with a specific resistance of 0.05 to 0.5 ohm-cm. (4) The high resistance films become low resistance as a result of gas etching. (5) The surface lifetimes of the minority carriers vary within insignificant limits and are small in magnitude following the gas etching. The variations in morphology of the films do not have theoretical differences by comparison with the variation of the substrate morphology. D.L.G.

N73-27666 Joint Publications Research Service, Arlington, Va.
OBTAINING SILICON EPITAXIAL FILMS BY THE SILANE METHOD
S. A. Ratenberg, R. M. Vasenin, and M. L. Vasenina *In its* Growth and Struct. of Monocrystalline Semicond. Films JPRS-59279-Pt-2) 14 Jun. 1973 p 97-101 refs Transl. into ENGLISH from the book "Protsessy Rosta i Struktura Monokristallicheskikh Sloyev Poluprovodnikov: Trudy Simpoziuma, Chast 2" Novosibirsk, Nauka Press, 1969 p 116-121 (For availability see N73-27650 18-26)

The results are discussed of a theoretical and experimental study of the reaction of thermal decomposition of silane in order to obtain high-quality epitaxial films. The thermodynamic calculations are shown along with the process kinetics determination. The laboratory setup used in the experiment is described, and the results obtained are compared with the analytical findings. D.L.G.

N73-27667 Joint Publications Research Service, Arlington, Va.
EPITAXIAL LAYERS OF SILICON OBTAINED BY PYROLYSIS OF HYDRIDES
T. A. Zeveke and V. A. Tolomasov *In its* Growth and Struct. of Monocrystalline Semicond. Films (JPRS-59279-Pt-2) 14 Jun. 1973 p 102-106 refs Transl. into ENGLISH from the book "Protsessy Rosta i Struktura Monokristallicheskikh Sloyev Poluprovodnikov: Trudy Simpoziuma, Chast 2" Novosibirsk, Nauka Press, 1969 p 122-128 (For availability see N73-27650 18-26)

The effects were studied of crystallization conditions on the properties of autoepitaxial and heteroepitaxial layers of silicon obtained by the method of hydride pyrolysis. A quartz reactor was used for the crystallization process and the substrate was heated by a high frequency current. The surface and structure of the films were investigated by means of optical, electron diffraction, and X-ray diffraction methods. The electrical properties of the films were measured by the Hall effect, the lifetime of the minority carriers, and by the method of modulation of the stationary photoconductivity with transulmination. The results are given and their significance discussed. D.L.G.

N73-27668 Joint Publications Research Service, Arlington, Va.
SELECTIVE GROWTH OF EPITAXIAL LAYERS OF SILICON
I. M. Skvortsov and V. V. Nikolayeva *In its* Growth and Struct. of Monocrystalline Semicond. Films (JPRS-59279-Pt-2) 14 May 1973 p 107-113 refs Transl. into ENGLISH from the book "Protsessy Rosta i Struktura Monokristallicheskikh Sloyev Poluprovodnikov: Trudy Simpoziuma, Chast 2" Novosibirsk, Nauka Press, 1969 p 129-137 (For availability see N73-27650 18-26)

Experiments were performed to study and determine the conditions for selectively growing epitaxial layers of silicon in the chloride process. The experiments were made in two directions: (1) checking results obtained by previous experiments and (2) determining the selective growth conditions from mixtures of H2SiCl4-HCL. Results show that selectiveness of the growth of silicon depends very strongly on the composition of the gas phase and the quality of the silicon oxides forming the mask.
Author

N73-27669 Joint Publications Research Service, Arlington, Va.
SELECTIVE GROWTH OF EPITAXIAL STRUCTURES OF GERMANIUM AND SILICON
E. O. Tizenberg, Ya. K. Deksne, Ya. A. Naglis, L. Ya. Kalnynsh, and L. P. Kalnach *In its* Growth and Struct. of Monocrystalline Semicond. Films (JPRS-59279-Pt-2) 14 Jun. 1973 p 114-117 refs Transl. into ENGLISH from the book "Protsessy Rosta i Struktura Monokristallicheskyikh Sloyev Poluprovodnikov: Trudy Simpoziuma, Chast 2" Novosibirsk, Nauka Press, 1969 p 138-142 (For availability see N73-27650 18-26)

The optimal conditions of selective growth of epitaxial layers of germanium and silicon. It is stated that the local epitaxial structures must satisfy the following requirements: (1) surface must be flat, (2) interface of local epitaxial regions and substrate must be perfect and not cause formation of defects in epitaxial regions during growth, and (3) local epitaxial structures must have uniform electrophysical properties with respect to their plate. The selective growth of both germanium and silicon was carried out in the windows of a protective mask made of silicon dioxide. Author

N73-27670 Joint Publications Research Service, Arlington, Va.
OBTAINING SILICON NITRIDE LAYERS ON SILICON BY GROWTH FROM THE GAS PHASE AND THE PROPERTIES OF THESE LAYERS
B. G. Anokhin, V. I. Myakinenkov, G. F. Lymar, Yu. V. Polikanov, and Sh. Shiashvili *In its* Growth and Struct. of Monocrystalline Semicond. Films (JPRS-59279-Pt-2) 14 Jun. 1973 p 118-123 refs Transl. into ENGLISH from the book "Protsessy Rosta i Struktura Monokristallicheskikh Sloyev Poluprovodnikov: Trudy Simpoziuma, uma, Chast 2" Novosibirsk, Nauka Press, 1969 p 143-149 (For availability see N73-27650 18-26)

The method for obtaining silicon nitride layers on silicon by growth from the gas phase and the properties of the layers are discussed. The application of amorphous silicon nitride for semiconductor devices and integrated circuits is analyzed. The advantages of the process are presented. The chemical reactions involved in the pyrolysis procedures are described. The physicochemical and electrical properties of silicon nitrides are analyzed. author

N73-27671 Joint Publications Research Service, Arlington, Va.
SOME CHARACTERISTIC FEATURES OF GROWTH ON EMBOSSED SUBSTRATES
V. M. Krasovskiy, Ye. S. Lyubimov, A. A. Milov, and K.-G. M. Shvarts *In its* Growth and Struct. of Monocrystalline Semicond. Films (JPRS-59279-Pt-2) 14 Jun. 1973 p 124-127 ref Transl. into ENGLISH from the book "Protsessy Rosta i Struktura Monokristallicheskikh Sloyev Poluprovodnikov: Trudy Simpoziuma, Chast 2" Novosibirsk, Nauka Press, 1969 p 150-154 (For availability see N73-27650 18-26)

The characteristics of crystal growth on embossed substrates are discussed. The method used consisted of photolithography and deep etching of silicon through a mask of photoresistance. Epitaxial growth was carried out at a substrate temperature of 1200 C for the minus conductivity layer and 1270 C for the positive conductivity layer. Special attention was given to obtaining epitaxial layers with a minimum number of lattice defects. The chemical reactions involved to discover the nucleation conditions of the packing defects for multilayered epitaxial growth are analyzed. Author

N73-27672 Joint Publications Research Service, Arlington, Va.
STUDY OF THE GROWTH OF MONOCRYSTALLINE FILMS OF SILICON CARBIDE ON SILICON
I. P. Neymane, M. K. Sano, I. A. Feltyn, and L. A. Freyberg *In its* Growth and Struct. of Monocrystalline Semicond. Films (JPRS-59279-Pt-2) 14 Jun. 1973 p 128-132 refs Transl. into ENGLISH from the book "Protsessy Rosta i Struktura Monokristallicheskikh Sloyev Poluprovodnikov: Trudy Simpoziuma, Chast 2" Novosibirsk, Nauka Press, 1969 p 155-159 (For availability see N73-27650 18-26)

The growth of monocrystalline films of silicon carbide on silicon is discussed. The nature of the process for growing the monocrystalline films is described. The equipment required for conducting the crystal growth is reported. The application of an etching process to determine the crystal structure is presented. Author

N73-27673 Joint Publications Research Service, Arlington, Va.
PROBLEM OF OBTAINING MONOCRYSTALLINE LAYERS OF SILICON BY THE RHEOTAXIAL METHOD
Ye. S. Lyubimov, I. V. Filatova, A. A. Milov, and V. G. Karpechenko *In its* Growth and Struct. of Monocrystalline Semicond. Films (JPRS-59279-Pt-2) 14 Jun. 1973 p 133-135 Transl. into ENGLISH from the Book "Protsessy Rosta i Struktura Monokristallicheskikh Sloyev Poluprovodnikov: Trudy Simpoziuma, Chast 2" Novosibirsk, Nauka Press, 1969 p 160-164 (For availability see N73-27650 18-26)

The procedure for obtaining monocrystalline layers of silicon by rheotaxial method is described. The use of semiconducting moncrystalline layers deposited on an insulating substrate for joint integrated circuits is reported. Methods for obtaining monocrystalline layers of silicon by reduction of silicon tetrachloride by hydrogen on polycrystalline insulating substrates coated with glass of complex composition are analyzed. Author

N73-27674 Joint Publications Research Service, Arlington, Va.
GROWTH KINETICS AND MORPHOLOGY OF AUTOEPITAXIAL GERMANIUM FILMS IN THE CHLORIDE METHOD
V. S. Kravchenko, A. A. Andreyeva, V. N. Vertoprakhov, and F. A. Kuznetsov *In its* Growth and Struct. of Monocrystalline Semicond. Films (JPRS-59279-Pt-2) 14 Jun. 1973 p 136-145 refs Transl. into ENGLISH from the book "Protsessy Rosta i Struktura Monokristallicheskikh Sloyev Poluprovodnikov: Trudy Simpoziuma, Chast 2" Novosibirsk, Nauka Press, 1969 p 165-186 (For availability see N73-27650 18-26)

A study was made of the effect of the temperature, the flow velocity, and the concentration of the germanium tetrachloride in the vapor-gas mixture on the growth kinetics and morphology of the films. A vertical reactor 72 mm in diameter was used. The heating was realized by high frequency induction currents. The temperature was measured by a platinum-platinorhodium thermocouple, and it was kept constant (variations within the limits of + or = 2 degrees). The substrates with (111) orientation were used. Author

N73-27675 Joint Publications Research Service, Arlington, Va.
EFFECT OF DISORIENTATION OF THE SUBSTRATES ON THE DEGREE OF LATTICE PERFECTION OF THE EPITAXIAL LAYERS OF GALLIUM ARSENIDE
L. G. Lavrentyevoy, M. P. Yakubenya, O. M. Ivlevoy, V. D. Dedkova, N. N. Ivanovoy, L. G. Nesteryuk, L. P. Porokhovnichenko, and V. V. Sklyarenko *In its* Growth and Struct. of Monocrystalline Semicond. Films (JPRS-59279-Pt-2) 14 Jun. 1973 p 146 Transl. Into ENGLISH from the book "Protsessy Rosta i Struktura Monokristallicheskikh Sloyev Poluprovodnikov: Trudy Simpoziuma, Chast 2" Novosibirsk, Nauka Press, 1969 p 187-188 (For availability see N73-27650 18-26)

Supplementary data tables and photographs on the effects of substrate disorientation on the degree of lattice perfection of gallium arsenide epitaxial layers are presented. E.H.W.

N73-27676*# Radio Corp. of America, Princeton, N.J.
GaN FOR LED APPLICATIONS Final Report, 18 Apr. 1972 - 17 Apr. 1973
J. I. Pankove May 1973 64 p refs
(Contract NAS1-11553)
(NASA-CR-132263; PRRL-73-CR-32) Avail: NTIS HC $5.25 CSCL 20L

In order to improve the synthesis of GaN the effect of various growth and doping parameters has been studied. Although Be, Li, Mg, and Dy can be used to overcompensate native donors, the most interesting acceptor element is Zn. The emission spectrum and the luminescence efficiency depend on the growth temperature (below 800 C), on the partial pressure of the doping impurity, and on the duration of growth. Blue-green electroluminescence with a power efficiency of 0.1 percent and a brightness of 850 fL (at 0.6 mA and 22.5 V) was obtained. Some diodes allow the color of the emitted light to change by reversing the polarity of the bias. Continuous operation of a diode over a period of 5 months showed no evidence of degradation. The luminescence properties of ion-implanted GaN were studied. Delay effects were found in the electroluminescence of diodes, although, with a dc bias, a 70-MHz modulation was possible. Author

N73-27677*# Southern Methodist Univ., Dallas, Tex. Electronic Sciences Center.
PHYSICAL PHENOMENA RELATED TO CRYSTAL GROWTH IN THE SPACE ENVIRONMENT
Ting L. Chu Washington NASA Jul. 1973 38 p refs
(Contract NAS1-11869)
(NASA-CR-2281) Avail: NTIS HC $3.00 CSCL 20L

The mechanism of crystal growth which may be affected by the space environment was studied. Conclusions as to the relative technical and scientific advantages of crystal growth in space over earth bound growth, without regard to economic advantage, were deduced. It was concluded that the crucibleless technique will most directly demonstrate the unique effects of the greatly reduced gravity in the space environment. Several experiments, including crucibleless crystal growth using solar energy and determination of diffusion coefficients of common dopants in liquid silicon were recommended. Author

N73-27678# National Bureau of Standards, Washington, D.C.
SPACE GROUND AND LATTICE COMPLEXES
Werner Fisher ((Philipps-Univ.), Hans Burzlaff Erlangen-Nuremberg Univ.), Erwin Hellner (Philipps-Univ.), and J. D. H. Donnay (Montreal Univ.) May 1973 185 p refs
(NBS-Monograph-134; LC-73-600099) Avail: SOD HC $4.10, Domestic Postpaid; HC $3.75, GPO Bookstore as C13.44:134

The lattice complex is to the space group what the site set is to the point group - an assemblage of symmetry-related equivalent points. The symoblism introduced by Carl Hermann was revised and extended. A total of 402 lattice complexes are derived from 67 Weissenberg complexes. The Tables list site sets and lattice complexes in standard and alternate representation. The following results are given: the co-ordinates of the points in a given lattice complex, the particular space groups of a lattice complex, and the lattice complexes that occur in a given space group. The higher the symmetry of the crystal structures, the more useful the lattice-complex approach would be for their classification. Author

N73-27679*# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
A STUDY OF LUNAR MODELS BASED ON APOLLO AND OTHER DATA Annual Report, 1 Mar. 1972 - 28 Feb. 1973
[Jan. 1973] 220 p refs
(Grant NGL-22-009-187)
(NASA-CR-133302) Avail: NTIS HC $13.00 CSCL 20L

The research concerned with the interpretation of lunar data developed during the Apollo Program is reported. The areas of research include: X-ray emission spectra and molecular orbitals of lunar materials, magnetic properties of lunar rock, lunar features, thermal history and evolution of the moon, and the internal constitution and evolution of the moon. F.O.S.

N73-27680# European Space Research and Technology Center, Noordwijk (Netherlands). Surface Physics Div.
SHORT-RANGE ORDERING IN AMORPHOUS Ge FILMS STUDIED BY HIGH RESOLUTION PHOTOMISSION
L. D. Laude, R. F. Willis, and B. Fitton Jul. 1972 8 p refs Presented at Intern. Conf. on Phys. of Semicond., Warsaw, 25-29 Jul. 1972
Avail: NTIS HC $3.00

The electronic structure of amorphous Ge films was studied using high resolution photoemission techniques, as a function of film preparation. From a comparsion with UHV-Cleved Ge (III) faces, the detailed nature of the short-range ordering phenomenon is analyzed and interpreted in terms of current theories in the field. Author (ESRO)

N73-27681*# Pennsylvania State Univ., University Park. Materials Research Lab.
ELASTIC PROPERTIES OF OXIDES AND THE SEARCH FOR TEMPERATURE-COMPENSATED MATERIALS
R. E. Newnham 30 Mar. 1973 33 p refs
(Contract F19628-73-C-0198; AF Proj. 5635)
(AD-760766; AFCRL-TR-73-0220; SR-1) Avail: NTIS CSCL 20/12

New temperature-compensated high piezoelectric coupling crystals are needed for acoustic surface-wave matched filters, encoders, decoders, and related signal processing devices. Elastic coefficients, together with their pressure and temperature derivatives, are also important in materials science and in geophysics. Oxides show several correlations between structure type and elastic behavior. A simple mechanical analogy in which atomic bonds are simulated by springs connected in series and parallel is used to estimate the size and anisotropy of the elastic moduli. Magnitudes of the temperature and pressure derivatives of the stiffness coefficients are also predicted by the model. Crystallochemical factors conducive to anomalous elastic behavior are examined, with special attention to materials which become stiffer with increasing temperature. (Author Modified Abstract) GRA

N73-27682# Maryland Univ., College Park. Dept. of Electrical Engineering.
THE STUDY OF THE INTERACTION OF INTENSE PICOSECOND LIGHT PULSE WITH MATERIALS: MULTIPHOTON CONDUCTIVITY IN SEMICONDUCTORS AND MEASUREMENT OF PICOSECOND PULSE WIDTH Quarterly Technical Report, 22 Dec. 1972 - 21 Mar. 1973
Chi H. Lee and Subramania Jayaraman 1 Apr. 1973 162 p refs
(Grant DA-ARO(D)-31-124-71-G82; ARPA Order 675)
(AD-760560; TR-013) Avail: NTIS CSCL 20/12

The two-photon conductivity in GaAs and CdS(0.5) - Se(0.5) and the three-photon conductivity in CdS were investigated with the use of Mode-locked Nd:glass laser as the exciting source. The square law dependence of the two photon conductivity and the cubic law dependence of the three-photon conductivity on the excitation intensity were subsequently used to measure the autocorrelation of the intensity in second and third order of the picosecond pulses from the mode-locked Nd:glass laser. The absorption coefficients estimated from the photoconductivity measurement were found to agree in order of magnitude with the theoretically calculated values from time dependent perturbation theory and the band structure of the semiconductor. (Author Modified Abstract) GRA

N73-27683# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLID STATE RESEARCH, 1973:1 Quarterly Technical Summary Report, 1 Nov. 1972 - 31 Jan. 1973
Alan L. McWhorter 15 Feb. 1973 75 p refs
(Contract F19628-73-C-0002; AF Proj. 649L)
(AD-760815; ESD-TR-73-63) Avail: NTIS CSCL 20/12

The report covers in detail the solid state research work of the Solid State Division at Lincoln Laboratory for the period 1 November 1972 through 31 January 1973. The topics covered are Solid State Device Research, Quantum Electronics, Materials Research, Physics of Solids, and Microelectronics. The Microsound work is sponsored by ABMDA and is reported under that program. Author (GRA)

N73-27684# Utah Univ., Salt Lake City. Dept. of Physics.
ELECTRONIC AND RADIATION DAMAGE PROPERTIES OF RUTILE Technical Report, 1 Aug. 1972 - 15 Mar. 1973
John W. DeFord, Owen W. Johnson, and Franz Rosenberger 15 Mar. 1973 22 p
(Grant DAHC15-73-G-2; ARPA Order 1610)
(AD-760667) Avail: NTIS CSCL 20/12

The report covers the period from 1 August 1972 to 15 Mar 1973. During this period effort has been concentrated in the following areas: crystal growth, magnetic resonance study of defects, hydrogen diffusion (experimental), hydrogen diffusion (theoretical), determination of conduction band parameters by use of hydrogen solubility theory developed in previous report, and far IR spectrometer. GRA

N73-27685# Case Western Reserve Univ., Cleveland, Ohio. Div. of Electrical Engineering and Applied Physics.
FARADAY ROTATION AND ATTENUATION IN InSb IN THE 10.6 MICRON WAVELENGTH REGION Final Report, 15 May - 15 Nov. 1972
Warren T. Boord and Yoh-Han Pao 1 Jun. 1973 33 p refs
(Contract N00014-67-A-0404-0012)
(AD-761213) Avail: NTIS CSCL 20/12

The investigation examined the dependence of free carrier Faraday Rotation on dopant nature and concentration and on crystal orientation. The extent of rotation varies linearly with

free carrier concentration. The wavelength dependence of absorption and Faraday rotation in the 10.6 microns wavelength region was measured. In addition to the effect of the tail of the interband effect and the free carrier effects, there were secondary structural details which could not be identified with any other plausible mechanism except that of deep donor levels due to donors at interstitial points. Wafers which were further lapped to reduce wafer thickness and were subsequently polished showed secondary structure of this nature to a greater degree than otherwise. GRA

N73-27686# National Materials Advisory Board, Washington, D.C.
OPPORTUNITIES IN HIGH-PRESSURE TECHNOLOGY Final Report
Jan. 1973 222 p refs
(Contract DA-49-083-OSA-3131)
(AD-760714; NMAB-303) Avail: NTIS CSCL 20/12

Potential applications of high-pressure technology, with particular reference to Department of Defense needs, were reviewed. The report consists of sections on science, synthesis, singering and densification, devices, polymers, dynamic high-pressure processes, and high-pressure equipment, all of which evolved from committee discussion. This is followed by 13 appendixes on specific topics. Author (GRA)

N73-27687# Utah Univ., Salt Lake City. Dept. of Physics.
GROWTH OF RUTILE SINGLE CRYSTALS BY CHEMICAL VAPOR TRANSPORT M.S. Thesis
Matthew Charles Delons Mar. 1973 81 p refs
(Grant DAHC15-71-G8)
(AD-760733; Preprint-2) Avail: NTIS CSCL 20/2

Single crystals of rutile (TiO2), 15 mm in diameter and 3 mm thick have been grown homoepitaxially in closed quartz ampoules via the overall chemical transport reaction $TiO2(s) + TeCl4(g) = TiCl4(g) + TeO2(g)$. The description of the experimental procedure includes details of a novel radiative heating and cooling arrangement which allows for growth of a crystal at a temperature lower than that of the ampoule containing it. The morphology of the grown crystals was found to depend on supersaturation. (Author Modified Abstract) GRA

N73-27688# Utah Univ., Salt Lake City. Dept. of Physics.
HEAT TRANSFER AND TEMPERATURE OSCILLATIONS IN CHEMICAL VAPOR TRANSPORT CRYSTAL GROWTH
F. Rosenberger, M. C. DeLong, and J. M. Olson Mar. 1973 34 p refs
(Grant DAHC15-71-G8)
(AD-760732; Preprint-1) Avail: NTIS CSCL 20/2

It is shown that the temperature profile inside a closed CVT ampoule can deviate greatly from that of its external heat source. This deviation is discussed in terms of the optical and convective properties of the system. Chemical convective instability can result in temperature oscillations of up to plus or minus 25C under typical growth conditions. Depending on the relative molecular weights of the reactants and products involved, CCI can occur in temperature gradients which are either parallel or antiparallel to gravity. This is demonstrated with the transport gases TeCl4 and I2 (both of which thermally dissociate) and discussed for ReO3 transport with I2, for which temperature instabilities had been observed earlier. GRA

N73-27689# Union Carbide Corp., San Diego, Calif. Crystal Products Dept.
RESEARCH AND DEVELOPMENT WORK FOR THE GROWTH OF SINGLE CRYSTAL YTTRIUM ORTHOVANADATE Final Technical Report, 1 Oct. 1971 - 1 Dec. 1972
Herman G. McKnight and Larry R. Rothrock Apr. 1973 64 p refs
(Contract DAAB07-72-C-0022)
(AD-761094; ECOM-0022-F-72) Avail: NTIS CSCL 20/2

The growth of yttrium orthovanadate large single crystals is reported. The two most promising crystal growth methods were investigated. The Bridgman method shows some promise with further development in vendor state-of-the-art, idirium fabrication technology, and a refinement in crucible design. The Czochralski method successfully yielded large a and c axis boules. Growth parameter development is described and the results evaluated. Glan-Foucault and Rochon polarizers have been assembled from prisms fabricated from these boules and tested. Author (GRA)

N73-27690# Maryland Univ., College Park. Dept. of Physics and Astronomy.
OPTICAL AND ELECTRICAL PROPERTIES OF AMORPHOUS ELEMENTAL SEMICONDUCTORS
Rolfe E. Glover, III and Robert Glosser 31 Dec. 1972 13 p refs
(Contract DA-ARO(D)-31-124-72-G150; ARPA Order 1562)
(AD-760595; AROD-9290.6-P) Avail: NTIS CSCL 20/12

The authors report results of electrical and optical measurements on amorphous silicon and germanium. It was found that the electrical and optical properties of amorphous silicon can be explained by a model in which internal surfaces or voids have electronic states corresponding to those found on cleaned crystalline surfaces. The results on amorphous germanium deposited at 4K show an absorption edge of 0.36 eV and parabolic behavior over a large range of energies. This is to be compared with the behavior of films deposited at 300K which shows a threshold of 0.85 eV and a deviation from parabolic behavior around 1 eV. Author (GRA)

N73-27691# Westinghouse Research Labs., Pittsburgh, Pa.
ELECTRON SPIN RESONANCE (ESR) STUDIES OF II-VI COMPOUNDS Final Report, 30 Jun. 1970 - 31 Jul. 1971
George R. Wagner and Joseph Murphy Wright-Patterson AFB, Ohio ARL Apr. 1973 94 p refs
(Contract F33615-70-C-1746; AF Proj. 7885)
(AD-760803; ARL-73-0069) Avail: NTIS CSCL 20/12

Electron spin resonance (ESR) studies are reported for Mn(2-), Eu(2-), and Ce(3-) in single crystals of CaS. The cubic field splittings, g-values, and hyperfine constants of Mn(2-) and Eu(2-) were determined and compared to those observed in other hosts. The ESR spectrum and spin-lattice relaxation of a hole center discovered in a crystal of CdS enriched in Cd114 were studied. Preliminary studies of ion-implanted II-VI crystals were undertaken. These included Li- in ZnSe and CdS and Mn(2-) in CdS and CaS. (Author Modified Abstract) GRA

N73-27692# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
CONCENTRATION AND TEMPERATURE STUDIES OF THE R-LINES OF RUBY
V. A. Gevorkyan, K. A. Malatyan, E. A. Kochinyan, and V. Kh. Sartisov 11 Apr. 1973 17 p refs Transl. into ENGLISH from Uch. Zap., Erevanskii Gos. Univ. (Erevan), v. 104, 1967 p 113-123
(Contract N00017-72-C-4401)
(AD-761374; APL-CLB-3-T-656) Avail: NTIS CSCL 07/4

The dependence of the duration and width of the R-lines of ruby luminescence on the concentration of chromium is studied. The dependence of the duration of luminescence lines on the length of the ruby crystal is also studied. With increasing chromium concentration in the ruby, the duration of the R-lines of luminescence decreases quickly at first, and then increases. When there is an increase of the chromium concentration, the width of the R-lines also increases, in which case the width of the R1 line increases more quickly than that of R2.
Author (GRA)

N73-27693# Watkins-Johnson Co., Palo Alto, Calif.
ELECTRON BEAM SEMICONDUCTOR SHORT PULSE GENERATOR Final Report, 1 Aug. 1970 - 1 Oct. 1972
Aris Silzars and Richard I. Knight May 1973 93 p refs
(Contract DAAB07-70-C-0268)
(AD-761111; W-J-22-4083-F; ECOM-0268-6-70) Avail: NTIS CSCL 09/5

Detailed analysis, design, and experimental verification of an electron beam semiconductor (EBS) amplifier for a high-speed high-current switching application has been completed. A large-signal computer simulation predicts that with an ideal diode structure over 450 amperes of output current can be achieved into an 0.5 ohm load with a risetime of less than 0.7 nanosecond. A gridded gun design was used as the most suitable approach. The cathode-grid structure showed over 80 percent of the design goal performance with uniform current density at

the target position. Large area semiconductor targets of 0.35 sq cm and 1.40 sq cm active area have been successfully fabricated from 37 micrometers thick, 22 ohm/cm epitaxial silicon. The best diodes have leakage currents of less than 10 mA at 250 volts reverse breakdown voltage. Tube processing and pulsed operation did not change the diode characteristics. (Author Modified Abstract) GRA

N73-27694# Utah Univ., Salt Lake City. Dept. of Physics.
ESR STUDIES OF Mo(PLUS 6), Mo(PLUS 5), Mo(PLUS 4), AND Mo (PLUS 3) IN RUTILE
W. D. Ohlsen Mar. 1973 10 p refs Sponsored in part by ARPA
(AD-760735; Preprint-3) Avail: NTIS CSCL 20/12

Hydrogen treatment was used to vary the Fermi level in Mo doped rutile. The stable valance states Mo(5-) and Mo(3-) were detected by ESR measurements. The existence of the states Mo(6-) and Mo(4-) could be inferred. The previously unreported Mo(3-) resonances can be fit by a spin Hamiltonian. (Author Modified Abstract) GRA

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N73-27695*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ROCKET PROPELLANT INJECTION Patent Application
George A. Repas, inventor (to NASA) Filed 15 Jun. 1973 8 p
(NASA-Case-LEW-11071-1; US-Patent-Appl-SN-370581) Avail: NTIS HC $3.00 CSCL 21I

A rocket propellant injector is provided in which all of the fuel flows through a porous faceplate for transpiration cooling. The oxidizer is swirled in tubular elements extending through the faceplate. NASA

N73-27696# Institut fuer Chemie der Treibstoffe, Berghausen (West Germany).
CONVERGENCE IMPROVEMENT FOR THE CALCULATION OF EQUILIBRIUM SYSTEMS USING THE NEWTON-RAPHSON METHOD [VERBESSERUNG DER KONVERGENZ BEI DER BERECHNUNG VON GLEICHGEWICHTS-SYSTEMEN NACH DEM NEWTON-RAPHSON-VERFAHREN]
H. Bathelt 15 Dec. 1972 27 p refs In GERMAN
(ICT-3/72) Avail: NTIS HC $3.50

A solution is given to the problem of convergence in calculating chemical equilibria by the Newton-Raphson method, especially for a system with the elements C, H, and F. A mixture of monomethyl hydrazine and F2 was taken as an example. Divergence occured in the calculation of the nozzle temperature for equilibrium. As a result, a diagonal element of the matrix, to be solved by Gauss elimination, became zero. The computer then had to divide by zero, and a solution was not possible. An attempt was made to obtain a solution for this badly conditioned system, and then to secure convergence by directed alterations in the iteration method, and to keep the number of iterations at a minimum in order to minimize computing time. ESRO

N73-27697# Boston Coll., Chestnut Hill, Mass. Dept. of Chemistry.
CHEMICAL KINETICS OF NITROGEN-HYDROGEN-FLUORINE SYSTEMS OF INTEREST AS ROCKET PROPELLANTS Final Scientific Report, 1 Mar. 1968 - 30 Sep. 1972
Donald I. MacLean Dec. 1972 32 p refs
(Grant AF-AFOSR-1523-68)
(AD-760770; FRK-124; AFOSR-73-0809TR) Avail: NTIS CSCL 21/2

The principle objective of the program was the study of the chemical kinetics of elementary reactions important in the combustion of several gas phase systems containing nitrogen, hydrogen and fluorine. Combustion systems were selected with a view to providing information essential either to advanced rocket propellant technology or chemical laser design. The report briefly summarizes research completed during the four and one half year period from 1 March 1968 to 30 September 1972. GRA

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N73-27698 National Lending Library for Science and Technology, Boston Spa (England).
HEAT TRANSFER IN LABYRINTH GLANDS IN GAS TURBINES
A. L. Kuzentsov and O. A. Zhuravlev Mar. 1973 8 p refs Transl. into ENGLISH from Energomashinestroenie (Moscow), v. 5, 1972 p 10-12
(NLL-RTS-7840) Avail: Natl. Lending Library, Boston Spa, Engl.: £0.90; 3 NLL photocopy coupons

An attempt was made to derive a formula for calculating heat transfer coefficients in the labyrinth glands of gas turbines over a wide range of geometry and conditions. Two glands, straight through and those with opposed fins were chosen for the study. A comparison of experimental conventional coefficients with values calculated by formula shows satisfactory agreement. Author

N73-27699* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SINGLE GRID ACCELERATOR FOR AN ION THRUSTOR Patent
Paul M. Margosian and Shigeo Nakanishi, inventors (to NASA) Issued 10 Jul. 1973 4 p Field 14 Sep. 1971 Continued-in-part of abandoned US Patent Appl. SN-758540, filed 9 Sep. 1968
(NASA-Case-XLE-10453-2; US-Patent-3,744,247;
US-Patent-Appl-SN-180473; US-Patent-Class-60-202;
US-Patent-Class-313-63; US-Patent-Class-313-217;
US-Patent-Class-313-218; US-Patent-Class-313-230;
US-Patent-Class-313-355; US-Patent-APPL-SN-758540) Avail: US Patent Office CSCL 21C

A single grid accelerator system for an ion thrustor is discussed. A layer of dielectric material is interposed between this metal grid and the chamber containing an ionized propellant for protecting the grid against sputtering erosion. Official Gazette of the U.S. Patent Office

N73-27700# Joint Publications Research Service, Arlington, Va.
ION ROCKET ENGINES
I. Merkulov 18 May 1973 6 p Transl. into ENGLISH from Aviat. Kosmonavt. (Moscow), no. 12, 1972 p 38-39
(JPRS-59061) Avail: NTIS HC $3.00

A brief review of the operating principles of ion rocket engines and their application for spacecraft propulsion are presented. The specific thrust of ion engines is compared with airbreathing engines and rocket engines. The advantages of the ion engine for specific phases of space flight are described. Author

N73-27701*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF A 1.20 PRESSURE RATIO STOL FAN STAGE AT THREE ROTOR BLADE SETTING ANGLES
George W. Lewis, Jr., Royce D. Moore, and George Kovich Washington Jul. 1973 32 p refs
(NASA-TM-X-2837; E-7434) Avail: NTIS HC $3.00 CSCL 21E

A model of a short takeoff and landing (STOL) fan stage was tested in a single-stage compressor research facility. Surveys of the airflow conditions ahead of the rotor, between the rotor and stator, and behind the stator were made over the stable

operating range of the stage. At the design speed of 213.3 meters per second and a weight flow of 31.2 kilograms per second, the stage pressure ratio of 1.15 was less than the design value of 1.2. The stage was tested with the rotor blades reset for more flow. Design pressure ratio was achieved and surpassed with the minus 5 deg and minus 7 deg resets, respectively. The stage efficiency was 0.88 for the minus 5 deg reset and 0.85 for the minus 7 deg reset. Author

N73-27702*# TRW Systems Group, Redondo Beach, Calif.
MONOPROPELLANT HYDRAZINE RESISTOJECT: ENGINEERING MODEL FABRICATION AND TEST TASK Summary Report
Charles K. Murch Mar. 1973 76 p
(Contract NAS5-11477)
(NASA-CR-132784; TRW-20266-6024-RO-00) Avail: NTIS HC $6.00 CSCL 21H

The monopropellant hydrazine resistojet, termed the electrothermal hydrazine thruster (EHT) by TRW systems, thermally decomposes anhydrous hydrazine propellant to produce a high-temperature, low-molecular-weight gas for expulsion through a propulsive nozzle. The EHT developed for this program required about 3-5 watts of electrical power and produced 0.020 to 0.070 pound of thrust over the inlet pressure range of 100 to 400 psia. The thruster was designed for both pulsed and steady state operation. A summary of the GSFC original requirements and GSFC modified requirements, and the performance of the engineering model EHT is given. The experimental program leading to the engineering model EHT design, modifications necessary to achieve the required thruster life capability, and the results of the life test prgram. Other facets of the program, including analyses, preliminary design, specifications, data correlation, and recommendations for a flight model are discussed. Author

N73-27703# National Aerospace Lab., Tokyo (Japan).
ON THE ULTRASONIC INSPECTION OF SEPARATION IN SOLID PROPELLANT ROCKET MOTORS
Morio Shimizu, Yoshio Noguchi, and Toshiharu Tanemura Dec. 1972 21 p refs In JAPANESE; ENGLISH summary
(NAL-TR-308) Avail: NTIS HC $3.25

The capability of an ultrasonic inspection technique to detect separation at the case-liner and liner-propellant interfaces is described. It is reported that the ultrasonic multiple reflection method now being used in factories, is most effective in detecting case-liner separation, but is not very effective in detecting liner-propellant separation. As a result of experiments using rocket models, it is found that a multiple reflection method is capable of detecting not only case-liner separation but also liner-propellant separation if a continuously variable frequency oscillator is used and the reflectograms are analyzed considering interfèrence. Author

N73-27704*# Pratt and Whitney Aircraft, East Hartford, Conn.
STUDY OF UNCONVENTIONAL PROPULSION SYSTEM CONCEPTS FOR USE IN A LONG RANGE TRANSPORT
George A. Champagne Aug. 1973 104 p ref
(Contract NAS3-15550)
(NASA-CR-121242; PWA-4692) Avail: NTIS HC $7.25 CSCL 21E

The noise level of an uncoventional propulsion system for the next generation of subsonic, long-range transport aircraft is discussed. The desired noise level may be achieved by: (1) a fixed geometry, high bypass ratio turbofan with a geared two-stage fan and advanced acoustic treatment or (2) a moderate bypass ratio turbofan with a variable pitch two-stage fan, variable primary and duct nozzles, and advanced acoustic treatment. The geared fan system meets the noise goal with minimum economic penalty. Comparison of the noise levels at takeoff and landing in combination with the economic penalties required to achieve the lower noise levels at specific noise measuring stations, indicate that both area reduction and current certification procedures should be used to ascertain the point of diminishing returns in establishing future noise goals. Author

N73-27705*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LIQUID PROPELLANT GAS GENERATORS NASA Space Vehicle Design Criteria (Chemical Propulsion)
Mar. 1972 110 p refs
(NASA-SP-8081) Avail: NTIS HC $3.00 CSCL 21H

The design of gas generators intended to provide hot gases for turbine drive is discussed. Emphasis is placed on the design and operation of bipropellant gas generators because of their wider use. Problems and limitations involved in turbine operation due to temperature effects are analyzed. Methods of temperature control of gas turbines and combustion products are examined. Drawings of critical sections of gas turbines to show their operation and areas of stress are included. Author

N73-27706*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
DEVELOPMENT OF A BIOWASTE RESISTOJET PROPULSION SYSTEM Final Report
Jul. 1973 122 p refs
(Contract NAS1-10961)
(NASA-CR-132269; MDC-G4745) Avail: NTIS HC $8.25 CSCL 21H

The equipment, exclusive of thrustors, required to demonstrate the feasibility of a resistojet propulsion system for space station attitude control application using representative simulated crew biowaste propellants and available resistojet thrustors in the ground simulation tests is discussed. The overall objective of the program was to provide a biowaste resistojet prototype propellant management and control system sufficiently simnilar to the flight article to permit concept feasibility and system demonstration testing of interface compatibility, operational characteristics, and system flexibility. Author

N73-27707*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
EXPERIMENTAL QUIET ENGINE PROGRAM. PREDICTED ENGINE PERFORMANCE
Feb. 1973 148 p Revised
(Contract NAS3-12430)
(NASA-CR-121258) Avail: NTIS HC $9.50 CSCL 21E

Three turbofan configurations, each incorporating alternative noise reduction features, were tested under the Quiet Engine Program. Performance data for these engines are shown over a range of flight conditions. The data are presented in tabular form for standard day flight inlet conditions. Procedures for estimating nonstandard day performance are shown. Tabular data and calculation procedures to allow determination of ram recovery, customer bleed, and customer shaft power extraction effects on engine performance can be found in the original Performance Brochure titled, Experimental Quiet Engine Program, Predicted Engine Performance, dated April 8, 1970. Predicted engine noise levels for representative take-off and approach conditions are provided. Author

N73-27708*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
NATURAL ENVIRONMENT DESIGN REQUIREMENTS FOR THE SOLAR ELECTRIC PROPULSION STAGE (SEPS)
Lewis E. Andrews 24 Jul. 1973 12 p refs
(NASA-TM-X-64761) Avail: NTIS HC $3.00 CSCL 21C

The natural environment design requirements for the solar electric propulsion stage are presented. Environment criteria for the SEP stage will cover earth orbital operations out to geosynchronous altitudes and also interplanetary missions including comet and asteroid missions. Author

N73-27709*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DYNAMIC RESPONSE OF MACH 2.5 AXISYMMETRIC INLET WITH 40 PERCENT SUPERSONIC INTERNAL AREA CONTRACTION
Robert J. Baumbick, Robert E. Wallhagen, George H. Neiner, and Peter G. Batterton Washington Jul. 1973 20 p refs
(NASA-TM-X-2833; E-7426) Avail: NTIS HC $3.00 CSCL 21E

Results of experimental tests conducted on a supersonic, mixed compression, axisymmetric inlet are presented. The inlet is designed for operation at Mach 2.5 with a turbofan engine (TF-30). The inlet was terminated with either a choked-orifice plate or a long pipe with variable area choked exit plug. Frequency

responses were obtained for selected static pressures in the diffuser. These pressures were selected as potential control signals for terminal shock control. Frequency responses were obtained for the Mach 2 and 2.5 conditions for different terminations. Responses also were obtained with and without cowl bleed. Internal disturbances were produced by sinusoidally varying the inlet overboard bypass doors at frequencies out to 100 hertz.
Author

N73-27710# Environmental Protection Agency, Ann Arbor Mich.
EDDE DART Interim Report
Thomas C. Austin Apr. 1972 6 p
(PB-218730/0; APTD-1404) Avail: NTIS HC $3.00 CSCL 13B

Tests were conducted on a vehicle with an induction system. The modification were made on a 1964 Dodge Dart equipped with the 1970 CID slant six cylinder engine and an automatic transmission. Extensive changes were made in the induction system of the vehicle to lower exhaust emissions. The main feature of the system was a special intake manifold which had been designed to remove liquid fuel from the intake charge. Additional modifications were also made to the carburetor's accelerator pump. A series of three tests were run, using the 1975 Federal Test Procedure. GRA

N73-27711# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.
AN EXPERIMENTAL STUDY OF THE EROSION REBOUND CHARACTERISTICS OF HIGH SPEED PARTICLES IMPACTING A STATIONARY SPECIMEN
G. Grant, R. Ball, and W. Tabakoff May 1973 46 p refs
(Grant DA-ARO(D)-31-124-71-G154)
(AD-760578; Rept-73-36; AROD-10223.4-E) Avail: NTIS CSCL 21/5

The impact and rebound characteristics of high speed solid particles have been experimentally determined. This study was limited to a system where the particle material is much harder than the target material and thus erosion takes place at impact. The impact parameters were found to be statistical in nature and thus the statistical distributions were obtained. The effect of the particle velocity and impact angle was also investigated. In additon, the rebound data was related to the erosion damage. Author (GRA)

N73-27712# ARO, Inc., Arnold Air Force Station, Tenn.
ANALYSIS AND COMPUTER PROGRAM FOR EVALUATION OF AIRBREATHING PROPULSION EXHAUST NOZZLE PERFORMANCE Final Report, Jun. 1970 - Nov. 1972
S. Wehofer and W. C. Moger AEDC May 1973 306 p refs
(AD-760541; ARO-ETF-TR-72-190) Avail: NTIS CSCL 21/5

An analytical technique based on the time-dependent flow equations has been developed to predict the inviscid transonic flow field in axisymmetric propulsion nozzles. The analysis includes the treatment of axisymmetric nonuniform nozzle inlet profiles of total pressure, total temperature, specific heat, and molecular weight. The analysis is also capable of considering convergent-divergent, convergent, and shrouded or unshrouded plug nozzle geometries. A computer listing and three sample calculations are presented to illustrate some of the capabilities of the program. Author (GRA)

N73-27713# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BASIC DIRECTIONS AND PROBLEMS OF INVESTIGATIONS ON THE IMPROVEMENT OF METHODS FOR CALCULATING AIR COOLING SYSTEMS FOR GAS TURBINES
I. T. Shvets and E. P. Dyban 10 May 1973 15 p refs Transl. into ENGLISH from Visn. Kiev Univ., Ser. Mat. ta Mekhan. (Kiev), no. 9, 1967 p 52-58
(AF Proj. 3066)
(AD-760964; FTD-HC-2300218-73) Avail: NTIS CSCL 21/5

Discussed are the basic principles developed at the Institute of Technical Heat Physics, AN USSR, and the Department of Aerohydromechanics and Heat Exchange of the University of Kiev, of methodology for calculating air cooling systems for multistage gas turbines, partially with the use of various types of computer models. The recommended method is widely accepted in practice for developing efficient turbine systems with initial gas temperatures on the order of 750 - 800C. Author (GRA)

N73-27714# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TESTING JET ENGINES (SELECTED ARTICLES)
L. S. Skulbachevskii 23 Apr. 1973 124 p Transl. into ENGLISH from the publ. "Ispytaniya Vozdushno-Reaktivnykh Dvigateley" Moscow, 1972 75 p
(AD-760963; FTD-MT-24-96-73) Avail: NTIS CSCL 21/5

The report is a compilation of articles that briefly describe the salient test parameters of jet engines and test methods used in the Soviet Union. GRA

N73-27715# Rockwell International Corp., Canoga Park, Calif. Rocketdyne Div.
INVESTIGATION OF THERMAL FATIGUE IN NONTUBULAR REGENERATIVELV COOLED THRUST CHAMBERS, VOLUME 1 Final Report
D. Fulton Edwards AFB, Ohio AFRPL May 1973 183 p refs
(Contract F04611-70-C-0014; AF Proj. 3058)
(AD-760582; R-9093-Vol-1; AFRPL-TR-73-10-Vol-1) Avail: NTIS; paper copy also available from NTIS $5.00/set of 2 reports as AD-760582-SET CSCL 21/8

An analytical method for predicting the thermal cycle life capability of nontubular regeneratively cooled thrust chambers was developed. Included in the method are the effects of time-dependent creep damage and strain range-dependent fatigue damage. The method was calibrated using material mechanical properties, isothermal fatigue, and tensile creep specimen data. Isothermal cyclic data on laboratory specimens to determine the effect of strain rate, temperature, strain range, and tensile and/or compression hold time on fatigue life of four candidate rocket engine thrust chamber materials was obtained. The experimental data and test procedure are presented. Also obtained was basic material data on the materials of interest. (Author Modified Abstract) GRA

N73-27716# Rockwell International Corp., Canoga Park, Calif. Rocketdyne Div.
INVESTIGATION OF THERMAL FATIGUE IN NONTUBULAR REGENERATIVELY COOLED THRUST CHAMBERS, VOLUME 2 Final Report
D. Fultons Edwards AFB, Ohio AFRPL May 1973 119 p
(Contract F04611-70-C-0014; AF Proj. 3058)
(AD-760583; R-9093-Vol-2; AFRPL-TR-73-10-Vol-2) Avail: NTIS CSCL 21/8

Long life non-tubular regeneratively cooled thrust chambers were fabricated and hot-fire cyclic tested to verify the life prediction techniques established in Volume I of this report. Chambers incorporating copper alloy (NARLoy-Z and zirconium copper) and nickel for the hot gas wall material and electroformed nickel closures were fabricated by Rocketdyne and hot fire cyclic tested by Rocketdyne and hot fire cyclic tested by the AFRPL. Propellants were LO2/H2 at a nominal mixture ratio of 6:1. Chamber pressure was 750 psia and thrust (corrected to vacuum and with a full area ratio nozzle) was 3300 pounds. A calorimeter thrust chamber assembly (calorimeter thrust chamber and coaxial injector) were also fabricated and hot-fire tested to establish the heat flux profile. Post-test analysis and metallurgical evaluation of the chamber were performed to locate and define fatigue cracks. Author (GRA)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

N73-27717 California Univ., Los Angeles.
THE INTERACTION BETWEEN THE SOLAR WIND AND INTERSTELLAR NEUTRAL PARTICLES Ph.D. Thesis
Edwin Michael Winter 1972 180 p

Avail: Univ. Microfilms Order No. 73-1742

The interaction between the solar wind and the interstellar neutral medium is studied through an extension of continuum techniques. These interstellar neutral particles, the presence of which in interplanetary space was determined by measurement of solar Lyman alpha back-scattered radiation, can be considered as a distributed source of mass, momentum, and energy sources in the continuum equations. A multi-fluid approach is utilized to arrive at a generalized Ohm's law relating the current to the electric field. With these sources, the solar wind is found to behave in a manner analogous to an ion-electron neutral plasma, coupled by collisions. In addition, the thermal energy equation is found to differ from the case without sources in the flow. Models of the density of these neutral particles are developed taking into account the effects of solar gravity, light pressure, varying composition, and temperature. Dissert. Abstr.

N73-27718*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A STUDY OF 30-300 MeV ATOMOSPHERIC GAMMA RAYS Ph.D. Thesis - Maryland Univ.

David J. Thompson Jun. 1973 157 p refs Submitted for Publication

(NASA-TM-X-66278; X-662-73-179) Avail: NTIS HC $10.00 CSCL 03B

Four balloon flights with a 15 cm by 15 cm digitized wire grid spark chamber are reported. This detector is designed to be sensitive only to gamma rays with energies above about 30 MeV. Energy and arrival direction of a gamma ray are determined from the negatron and positron produced when the gamma ray interacts. The results show that the gamma ray flux and energy spectrum vary with altitude and with zenith angle in the atmosphere. For downward moving photons, the flux has a strong peak at an atmospheric depth between 100 and 200 gm/sq cm. The energy spectrum steepens continuously in going from the top of the atmosphere to near ground level. For gamma rays moving in a generally horizontal direction, the flux is nearly constant between the top of the atmosphere and a depth of 100 gm/sq cm. Author

N73-27719*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

PIONEER SOLAR PLASMA AND MAGNETIFIC FIELD MEASUREMENTS IN INTERPLANETARY SPACE DURING 2-17 AUGUST 1972

J. D. Mihalov, D. S. Colburn, B. F. Smith, C. P. Sonett, and J. H. Wolfe May 1973 17 p refs

(NASA-TM-X-62291) Avail: NTIS HC $3.00 CSCL 03B

Solar wind palsma and magnetic field measurements from Pioneers 9 and 10 during August 2 - 17, 1972, reveal complex and large-amplitude variations on a one-hour time scale and numerous discontinuities. During this time period an approximate radial alignment of the two spacecraft as seen from the Sun occurred with heliocentric distances of 0.8 AU for Pioneer 9 and 2.2 AU for Pioneer 10, both at 45 deg east of the Earth's solar longitude. The peak hourly average solar wind proton bulk velocity measured at Pioneer 9 was 990 km/sec during hour 0 UT of August 5. The peak hourly average proton number density was 62/cu cm during hour 11 UT of August 3. The peak solar wind speeds are generally much reduced at Pioneer 10 compared with those observed at Pioneer 9. The peak 30 minute average magnetic field magnitude was 85 gamma during 1245-1315 UT of August 3. The Pioneer 9 data indicate passage of four fast forward interplanetary shocks, and one slow forward interplanetary shock. Author

N73-27720*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SPATIAL DISTRIBUTION OF SOFT X-RAY AND EUV EMISSION ASSOCIATED WITH A CHROMOSPHERIC FLARE OF IMPORTANCE 1B ON 2 AUGUST 1972

W. M. Neupert, R. J. Thomas, and R. D. Chapman Jul. 1973 56 p refs

(NASA-TM-X-66299; X-682-73-10) Avail: NTIS HC $5.00

Soft X-ray and extreme ultraviolet spectroheliographs carried by the OSO-7 were used to record the development of XUV emission associated with a flare of Importance 1B on August 2, 1972. Spatial resolution was 20 arc sec and spectral resolution was adequate to select emission lines originating within well-defined ranges of electron temperature between 50,000 and 30,000,000 K. The data show that heating only the pre-existing coronal material adjacent to the flare site cannot account for the soft X-ray emission measure observed during the event. The flare emission originating at T sub e = to or less than 2,300,000 K exhibits an impulsive component coincident with an impulsive microwave event. This radiation appears to coincide spatially with H alpha radiation emitted at that time and is centered on the neutral line separating magnetic fields of opposite polarity. The region with highest electron temperature exhibits the greatest stability in position. This region cools to approximately 10,000,-000 K in 6 to 12 minutes which is compatible with cooling by conduction to the chromosphere. The best association with a dark surge is found in an emission line of Fe 14. Author

N73-27721*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

ANALYSIS OF SOLAR X-RAY DATA

L. W. Acton and W. T. Zaumen May 1973 51 p refs

(Contract NASw-2316)

(NASA-CR-133341) Avail: NTIS HC $4.75 CSCL 03B

Measurements of the intensity of a group of iron lines around 1.9A and the X-ray continuum in the 1 to 3A region have been obtained from rocket experiments during the declining phases of two small solar flares. The electron temperature, effective ionization temperature of iron, electron density and source volume as a function of time are interpreted in terms of the plasma cooling mechanisms. Also included is a review of observational material from a variety of space measurements on solar activities. G.G.

N73-27722# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.

EFFECT OF STRATOSPHERIC OZONE DEPLETION ON THE SOLAR ULTRAVIOLET RADIATION INCIDENT ON THE SURFACE OF THE EARTH

Pythagoras Cutchis Mar. 1973 47 p refs

(Contract DAHC15-73-C-0200)

(AD-761179; P-922; IDA/HQ-72-14697) Avail: NTIS CSCL 06/18

Recent theoretical work indicates that the oxides of nitrogen that would be injected into the stratosphere by a fleet of supersonic transport aircraft could result in a significant depletion of natural stratospheric ozone. Since the stratospheric ozone layer shields the biosphere from harmful ultraviolet (UV) radiation, there is concern about the biological effects of the increase in UV radiation that would attend a reduction in the present amount of natural ozone. The paper estimates the factor by which UV radiation would be increased as a function of percentage ozone depletion and wavelength. To illustrate a potentially significant biological effect of increased UV radiation, the attendant increase in erythemal (sunburn-producing) UV radiation dosage is calculated for several conditions of ozone depletion, radiation wavelength, and solar zenith angle. Author (GRA)

N73-27723# Hale Observatories, Pasadena, Calif.

A STUDY TO EXTEND THE KNOWLEDGE OF SOLAR ACTIVE REGIONS AND ASSOCIATED PHENOMENA Final Report, 1 May - 31 Dec. 1972

Robert F. Howard Bedford, Mass. AFCRL 30 Jan. 1973 10 p

(Contract F19628-72-C-0208; AF Proj. 8608)

(AD-760124; AFCRL-TR-73-0120) Avail: NTIS CSCL 03/2

More than 275 full-disk scans of the solar surface were made at the Mount Wilson Observatory in several spectrum lines. Analysis of the resulting velocity signals indicates that although the equatorial velocities measured with the FeI and FeII lines are identical, the high latitude rotations differ. The ionized line shows a more rapid falloff of angular velocity with latitude than does the neutral line. This is an exciting and unexpected result that will be studied in more detail. The limb redshift parameters from the two lines differ by nearly a factor two, with the ionized line having the larger value. Variations with time in the equatorial velocities measured with the two lines were nearly the same. The average equatorial velocities over the observing period were significantly faster than for a comparable period

five years ago. This may be associated with a lower level of solar activity. Author (GRA)

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N73-27724 Brown Univ., Providence, R.I.
ON THE SEPARATION OF THE ANNUAL AND CHANDLER SPECTRAL COMPONENTS IN ASTRONOMIC LATITUDE AND POLAR MOTION DATA Ph.D. Thesis
Frederick Joseph Wells 1972 239 p
Avail: Univ. Microfilms Order No. 73-2350

The basic problems in analyzing polar motion data which is to be considered is the efficient separation of the two major spectral components in polar motion data for short time windows. These two components are the Chandler component of period about fourteen months and the annual component of period twelve months. To accomplish this separation, a perturbation method is devised which relies on a spectral estimation technique. The perturbation procedure is applied to ten latitude series from observatories of the International Polar Motion Service. Each time series is approximately nine years in length. For testing and comparison, the commonly used harmonic analysis was also applied to the data. Dissert. Abstr.

N73-27725# Sydney Observatory (Australia).
ASTROGRAPHIC CATALOGUE, 1900-0: SYDNEY SECTION DEC. -51 DEG TO -65 DEG, VOLUME 53
1971 64 p refs
Avail: NTIS HC $5.25

An astronomical catalog covering calculations made of standard coordinates, equatorial coordinates, and reference stars is presented. Data were taken from Sydney's photographic plates and include errors and corrections to each reseau. E.H.W.

N73-27726*# University Research Foundation, San Diego, Calif.
ASTEROID AND COMET EXPLORATION
G. Arrhenius, H. Alfven, and R. Fitzgerald Washington NASA Jul. 1973 58 p refs Prepared in cooperation with Calif. Univ., San Diego
(Contract NAS8-27929)
(NASA-CR-2291) Avail: NTIS HC $3.00 CSCL 03B

Exploration of Venus, Mars, and the Moon have had two major scientific objectives. One was to clarify the processes which control planetary evolution. The fulfillment of this purpose, although far from complete, was eminently successful in generating entirely new perspectives on the growth and differentiation of earth. The second objective, particularly prominent in the planning of the lunar exploration, was to augment the understanding of the virtually unknown preplanetary history of the solar system. This would include the fundamental questions of the origin, emplacement, and state of matter gathered around the sun and some planets. Preplanetary history also inquires into the problems of fractionation, condensation, and non-gravitation aggregation of circumsolar and circumplanetary matter. Author

N73-27727# Joint Publications Research Service, Arlington, Va.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 302
14 Jun. 1973 53 p Transl. into ENGLISH of Russian reports
(JPRS-59278) Avail: NTIS HC $4.75

Translations and abstracts of articles reported cover meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial geophysics, science news and formal scientific reports. Published details of Soviet space spectaculars are included. Author

N73-27728*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GALACTIC BACKGROUND MAPS AT 3.93 AND 6.55 MHz M.S. Thesis - Maryland Univ.
James C. Novaco Jun. 1973 147 p refs
(NASA-TM-X-66280; X-693-73-182) Avail: NTIS HC $9.50 CSCL 03B

The Radio Astronomy Explorer Satellite (RAE-1), its hardware and its data processing are discussed. The data from the prime mapping antenna are discussed with emphasis on the problems involved in reducing the data. Particular attention is drawn to two problems - receiver instability and ground breakthrough - and their influence on the data. Galactic background maps of the nonthermal radiation at 3.93 and 6.55 MHz are produced. It is demonstrated that the positional uncertainity of the maps is about 20 deg. The maps at 3.93 and 6.55 MHz are compared to two ground based maps made at higher frequencies that are smoothed to the larger RAE antenna patterns. Author

N73-27729# Joint Publications Research Service, Arlington, Va.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 300
14 May 1973 79 p refs Transl. into ENGLISH from various Soviet bloc publications
(JPRS-59002) Avail: NTIS HC $6.00

Translations and abstracts of articles on meteorology, oceanography, upper atmosphere and space research, astronomy, and terrestrial geophysics are presented, covering both science news and formal scientific reports. Published details of Soviet space events are included. Author

N73-27730# Joint Publications Research Service, Arlington, Va.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 304
11 Jul. 1973 41 p refs Transl. into ENGLISH from various Soviet bloc publications
(JPRS-59490) Avail: NTIS HC $4.25

Translations and abstracts of articles are reported on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial geophysics, covering both science news and formal scientific reports. Published details of Soviet space spectaculars are included. Author

N73-27731# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
OPTICAL CONSTANTS FOR TERRESTRIAL ANALOGS OF LUNAR MATERIALS
W. G. Egan and T. Hilgeman Jul. 1973 27 p refs Submitted for publication
(RM-574J) Avail: NTIS HC $3.50

Representative terrestrial analogs of the dominant lunar constituents plagioclase feldspar and pyroxene were selected. The refractive, absorption and scattering components were determined separately in the range from 0.33 to 2.3 microns. A newly developed theory was employed to separate the absorption from the scattering based on thin section total reflectance and transmission measurements. The selected minerals were bytownite (Minnesota) and augite (Ontario, Canada); a comparison of their absorption peaks with those inferred from reflectance measurements on lunar samples reveal comparable bands at 2.0, 1.3, 1.0 to 0.9, 0.6 microns and the UV. The similarities indicate that the optical constants reasonably characterize the lunar surface material. Another result is the introduction of plagioxlase as a possible candidate material causing the 0.6 micron feature in asteroids and in the interstellar medium. Author

N73-27732*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NSSDC INDEX OF INTERNATIONAL SCIENTIFIC ROCKET LAUNCHES ORDERED BY SPONSERING COUNTRY/AGENCY
Feb. 1972 214 p
(NASA-TM-X-69350; NSSDC-72-05; W-124) Avail: NTIS HC $12.75 CSCL 22C

International scientific rocket launches are listed by discipline codes and by sponsoring country/agencies identifications. Launch sites, experiments, approximate apogee, success and principle experimenters are also shown. G.G.

N73-27733# Joint Publications Research Service, Arlington, Va.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 303
28 Jun. 1973 79 p refs Transl. into ENGLISH from various Soviet bloc publications
(JPRS-59390) Avail: NTIS HC $6.00

Translations and abstracts are reported of articles on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial geophysics, covering both science news and formal scientific reports. Published details of Soviet space spectaculars are included. Author

N73-27734*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GPS EARLY-ORBIT SUBSYSTEM FOR EARTH SATELLITES
V. T. Laczo and J. L. Maury Dec. 1972 65 p refs
(NASA-TM-X-66286; X-552-72-502) Avail: NTIS HC $5.25 CSCL 22A

The early-orbit capability of the Goddard Trajectory Determination System, which determines starting vectors for earth satellites from angles-only or range-angles observations, is described and documented. Early-orbit results obtained from a variety of satellites, data types and methods of solution are also presented. Author

N73-27735*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ARE THE RECENTLY OBSERVED SOFT GAMMA-RAY BURSTS FROM STELLAR SUPER FLARES?
F. W. Stecker and K. J. Frost Jul. 1963 6 p refs Submitted for publication
(NASA-TM-X-66294; X-641-73-217) Avail: NTIS HC $3.00 CSCL 03A

The discovery of soft gamma ray bursts has led to the speculation that these bursts are caused by the bremsstrahlung of electrons accelerated to high energies in a stellar flare event. If the stellar flare hypothesis is verified, it may imply a significant source of low energy cosmic rays in the solar neighborhood, depending on the frequency and intensity of the flares. A.L.

N73-27736*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PIONEER-10 MEASUREMENTS OF THE DIFFERENTIAL AND INTEGRAL COSMIC-RAY GRADIENT BETWEEN 1 AND 3 AU
B. J. Teegarden, F. B. McDonald, J. H. Trainor, E. C. Roelof, and W. R. Webber Jul. 1973 16 p refs Submitted for publication
(NASA-TM-X-66293; X-661-73-201) Avail: NTIS HC $3.00 CSCL 03B

The cosmic-ray experiment on Pioneer has provided measurements of the differential radial gradeint of comsic-ray helium nuclei between 1 and 3 AU. Upper limits are quoted between 10 and 500 MeV/nuc which are everywhere < 25%/AU and in some cases substantially smaller. The integral proton gradient (> 56 MeV) was also measured and found to have the following values: 2.4 + or - 0.3%/AU (1-2 AU), 7.6 + or - 0.7%/AU (2-3 AU). Author

N73-27737*# Martin Marietta Corp., Denver, Colo.
SITE ALTERATION EFFECTS FROM ROCKET EXHAUST IMPINGMENT DURING A SIMULATED VIKING MARS LANDING. PART 1: NOZZLE DEVELOPMENT AND PHYSICAL SITE ALTERNATION
G. L. Romine, T. D. Reisert, and J. Gliozzi Washington NASA Jul. 1973 169 p refs
(Contract NAS1-9000)
(NASA-CR-2252) Avail: NTIS HC $3.00 CSCL 22A

A potential interference problem for the Viking '75 scientific investigation of the Martian surface resulting from retrorocket exhaust plume impingement of the surface was investigated experimentally and analytically. It was discovered that the conventional bell nozzle originally planned for the Viking Lander retrorockets would produce an unacceptably large amount of physical disturbance to the landing site. An experimental program was subsequently undertaken to find and/or develop a nozzle configuration which would significantly reduce the site alteration. A multiple nozzle configuration, consisting of 18 small bell nozzles, was shown to produce a level of disturbance that was considered by the Viking Lander Science Teams to be acceptable on the basis of results from full-scale tests on simulated Martian soils. Author

N73-27738*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
APPLICATION OF MATCHED ASYMPTOTIC EXPANSIONS TO LUNAR AND INTERPLANETARY TRAJECTORIES. VOLUME 1: TECHNICAL DISCUSSION
J. E. Lancaster Washington NASA Jul. 1973 110 p refs
(Contract NAS9-10526)
(NASA-CR-2255; MDC-G2748-Vol-1) Avail: NTIS HC $3.00 CSCL 22A

Previously published asymptotic solutions for lunar and interplanetary trajectories have been modified and combined to formulate a general analytical solution to the problem on N-bodies. The earlier first-order solutions, derived by the method of matched asymptotic expansions, have been extended to second order for the purpose of obtaining increased accuracy. The derivation of the second-order solution is summarized by showing the essential steps, some in functional form. The general asymptotic solution has been used as a basis for formulating a number of analytical two-point boundary value solutions. These include earth-to-moon, one- and two-impulse moon-to-earth, and interplanetary solutions. The results show that the accuracies of the asymptotic solutions range from an order of magnitude better than conic approximations to that of numerical integration itself. Also, since no iterations are required, the asymptotic boundary value solutions are obtained in a fraction of the time required for comparable numerically integrated solutions. The subject of minimizing the second-order error is discussed, and recommendations made for further work directed toward achieving a uniform accuracy in all applications. Author

N73-27739*# California Univ., La Jolla. Dept. of Physics.
INFRARED SPECTROMETER INVESTIGATIONS OF THE PLANETS AND PLANETARY SATELLITES Final Technical Report
E. C. Gillett 26 Jun. 1973 5 p
(Grant NGR-05-009-142)
(NASA-CR-133413) Avail: NTIS HC $3.00 CSCL 03A

A set of cooled filter wheel spectrometers covering the wavelength range 2.8-24 micron have been constructed and tested. The two short wavelength systems (2.8-5.6 micron and 7-14 micron) have been found to be very useful and provide a substantial increase in signal to noise over previous systems. The 12-24 micron system, although still very useful, suffers from a low transmittance filter wheel and possibly poor wavelength resolution, intrinsic to the filter wheel. Author

N73-27740# Royal Greenwich Observatory, Herstmonceux (England). Time and Latitude Service.
GREENWICH TIME REPORT, APRIL-JUNE 1972
Jun. 1972 14 p
Avail: NTIS HC $3.00

Results of Greenwich time and latitude observations for the period April - June 1972 are presented. Also included are radio time signals and standard frequency emissions. ESRO

N73-27741# Owens Valley Radio Observatory, Pasadena, Calif.
NEUTRAL HYDROGEN APERTURE SYNTHESIS MAPS OF IC2574 AND NGC 7640
G. A. Seielstad and M. C. H. Wright 1973 23 p refs
(Contract N00014-67-A-0094-0019)
(AD-757688; Rept-1973-5) Avail: NTIS HC $3.00 CSCL 03/2

Aperture synthesis observations with an angular resolution about 2 arc-min of two late-type galaxies have revealed HI distributions some 1.5 times larger than their photographic images. IC2574, classified as an irregular galaxy, has a well organized velocity field typical of a late spiral galaxy. The major HI concentrations do not correspond with the brightest optical features. A ridge of peculiar velocities of about 10 km/s in the region of the optical bar may indicate streaming motions of gas along the bar. NGC7640 is an SBc galaxy at an inclination of

77 degrees. There is no evidence of any HI halo brighter than 100 degrees K km/s, although there is a suggestion of warping of the plane of the HI layer. Author (GRA)

N73-27742# Chicago Univ., Ill. Lab. for Astrophysics and Space Research.
DEFINITION STUDY OF X-RAY BACKGROUND EXPERIMENT ON HEAO-A Final Report
Richard L. Blake 31 Jan. 1973 13 p refs
(Contract N00014-67-A-0285-0016)
(AD-759738) Avail: NTIS CSCL 03/2

Work is directed toward laboratory and analytical studies related to the design of a module in the NRL-LAXRAY experiment on HEAO-A5. The module is designed specifically for emphasis on the cosmic diffuse X-ray background. (Author Modified Abstract) GRA

N73-27743# TRW Systems Group, Redondo Beach, Calif.
THE PLANET MARS: A SELECTED BIBLIOGRAPHY Special Literature Survey No. 61
L. R. Magnolia, comp. 20 Apr. 1973 23 p refs
(AD-759291; Rept-99900-7717-TU-00) Avail: NTIS CSCL 03/2

The document contains a bibliographic listing of 231 reports pertaining to Mars. GRA

N73-27744# Owens Valley Radio Observatory, Pasadena, Calif.
APERTURE SYNTHESIS OF INTERSTELLAR NEUTRAL HYDROGEN IN ABSORPTION. 2: CYGNUS A, THE CRAB NEBULAR, AND OTHER SOURCES
Eric W. Greisen 1973 48 p refs
(Contract N00014-67-A-0094-0019)
(AD-760013; Rept-1973-8) Avail: NTIS CSCL 03/2

The Owens Valley Radio Observatory interferometer has been used to carry out a program of aperture synthesis in the interstellar neutral hydrogen line. The results of synthesis observations of Cygnus A, the Crab Nebula and 3C353 and single-spacing observations of W12 and 3C147 are presented. Considerable spatial structure in the absorbing medium is found with scale lengths about 1 pc (and perhaps even as small as 0.14 pc) being common. Some of the small-scale features are seen as condensations within much larger clouds. The hydrogen densities appear to be mostly on the order of 100/cc. Upper limits to the temperatures lower than 50K are found for some spectral components, but upper limits between 80 and 160K are more common. The implications of these results for the two-phase model of the interstellar medium are discussed. (Author Modified Abstract) GRA

N73-27745# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
THE CONTRIBUTION OF ASTEROIDS TO THE INFRARED ASTRONOMICAL SKY SURVEY
Thomas L. Murdock 9 Mar. 1973 12 p refs
(AF Proj. 7670)
(AD-760107; AFCRL-TR-73-0154; AFCRL-ERP-439) Avail: NTIS CSCL 03/2

The use of any infrared sensor for sky survey measurements is complicated by signals from objects in the solar system. The identification of planets is trivial but asteroids and other small bodies form a large class of objects which cannot be recognized as readily. In the 8- to 30-micron region they are an especially significant possible source of signals. With a median period of 4.6 years, asteroid motions of about a quarter of a degree per day are typical, implying that each observation must be treated independently to properly identify asteroids. As infrared detectors become more sensitive, previously unknown asteroids will appear and must be identified as such. Author (GRA)

N73-27746# Owens Valley Radio Observatory, Pasadena, Calif.
HIGH ANGULAR RESOLUTION OBSERVATIONS OF SATURN AT 21.1 CM WAVELENGTH
Glenn L. Berge 1973 27 p refs
(Contract N00014-67-A-0094-0019)
(AD-760014; Rept-1973-9) Avail: NTIS CSCL 03/2

Saturn was observed with an interferometer at a wavelength of 21.1 cm in an effort to determine whether any of the emission at this wavelength originates from outside the area of the visible disk. The result, in terms of upper limits, is that no more than 6 percent can come from the visible rings nor more than 5 percent from a radiation belt, assuming brightness distribution models that the authors describe. The latter limit implies that the volume emissivity of a hypothetical Saturn radiation belt has an upper limit of only about 1 percent of that for Jupiter in corresponding regions. The measured disk temperature is 232 plus or minus 18K. Author (GRA)

N73-27747# National Research Council, Washington, D.C. Astronomy Survey Committee.
ASTRONOMY AND ASTROPHYSICS FOR THE 1970'S. VOLUME 2: THE REPORTS OF THE PANELS
Apr. 1973 417 p refs
(PB-219589/9; LC-72-79131; ISBN-0-309-02110-3) Avail: NTIS MF $0.95; National Academy of Sciences, Printing and Publishing Office, 2101 Constitution Ave., N. W., Washington, D. C. 20418 HC $14.25 CSCL 03B

The panel reports of Astronomy and Astrophysics for the 1970's, Volume 2, form the basis of the study that appears in Volume 1. Specific panel reports include: Radio Astronomy, Optical Astronomy, Infrared Astronomy, Space Astronomy, Solar Astronomy, Theoretical Astrophysics, Dynamical Astronomy, Astrophysics and Relativity, and Statistics. These reports provide guidance as to the major trends anticipated in astronomical and astrophysical research. They also list instrumental facilities, auxiliary equipment, and programs of theoretical research. Author (GRA)

N73-27748# Oslo Univ. (Norway). Inst. of Theoretical Astrophysics.
ISOTOPIC COMPOSITION OF SOME METALS IN THE SUN
Oivind Hauge 14 Sep. 1972 80 p refs
(Grant AF-AFOSR-2294-72; AF Proj. 7649)
(AD-758769; AFCRL-TR-73-0130) Avail: NTIS CSCL 03/2

Information on the isotopic composition of chemical elements in the sun may be obtained by analysis of photospheric and sunspot spectra. It is shown that besides investigations performed on molecular lines, information on isotope abundances of some heavier elements may also be derived from atomic line studies. A discussion of the elements Tb, Sr, Sb and Eu are described. Studies of the solar isotopic composition of Cu from analysis of Cu I lines in photospheric spectra and CuH lines in sunspot spectra are described. (Author Modified Abstract) GRA

N73-27749# Oslo Univ. (Norway). Inst. of Theoretical Astrophysics.
A COMMENT ON CONTRIBUTION FUNCTIONS
H. Sorli and O. Engvold 31 Oct. 1972 11 p refs
(Grant AF-AFOSR-2294-72)
(AD-758770; AFCRL-TR-73-0148) Avail: NTIS CSCL 03/2

The contribution function for emergent radiation in spectral lines is the integrand of the equation of transfer. Numerical examples are used to compare this and various types of contribution functions that refer to the line contrast. It is seen that only for the integrand of the equation of transfer does the maximum occur where the total optical depth equals 1, i.e. near the height of formation of the observed radiation for both weak and strong lines. Author (GRA)

N73-27846* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE CALCULATION OF EFFICIENT HIGH PRECISION ORBITS BY OPTIMUM MATCHING OF THE FORMULATION AND NUMERICAL INTEGRATOR
Carmelo E. Velez *In its* Significant Accomplishments in Technol., 1972 1973 p 125-128 (For availability see N73-27816 18-34)
CSCL 22C

N73-27847* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ERTS ORBIT MAINTENANCE
Arthur J. Fuchs *In its* Significant Accomplishments in Technol., 1972 1973 p 129-131 (For availability see N73-27816

18-34)
CSCL 22C

N73-27852* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERACTIVE EXPERIMENTERS' PLANNING PROCEDURES AND MISSION CONTROL
Richard L. DesJardins *In its* Significant Accomplishments in Technol., 1972 1973 p 147-154 (For availability see N73-27816 18-34)
CSCL 22A

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also; 28 Propulsion Systems; and 32 Structural Mechanics.

N73-27750# Radio and Space Research Station, Slough (England).
CATALOGUE OF ROCKET AND SATELLITE DATA, ISSUE NO. 1, 1972
1972 44 p
Avail: NTIS HC $4.25 CSCL 22C

A world catalog covering rocket launch and satellite launch and sighting data is presented. E.H.W.

N73-27751*# Lockheed Missiles and Space Co., Palo Alto, Calif.
SHUTTLE CRYOGENIC SUPPLY SYSTEM OPTIMIZATION STUDY. VOLUME 2: TECHNICAL REPORT, SECTIONS 4 THROUGH 9 Final Report, Oct. 1970 - Jun. 1973
Jun. 1973 464 p refs 11 Vol.
(Contract NAS9-11330)
(NASA-CR-128993; LMSC-A991396-Vol-2) Avail: NTIS HC $25.25 CSCL 22B

The design and development of cryogenic supply systems for space shuttle vehicles are discussed. The weights, component counts, and statements of advantages and disadvantages of the systems considered are presented. Performance characteristics of the systems are analyzed in the form of graphs. Block diagrams and engineering drawings of the candidate systems are provided. Special consideration is given to flow rates and thermodynamic properties of the cryogenic systems. Author

N73-27752*# Lockheed Missiles and Space Co., Palo Alto, Calif.
SHUTTLE CRYOGENIC SUPPLY SYSTEM OPTIMIZATION STUDY. VOLUME 3: TECHNICAL REPORT, SECTION 10, 11 AND 12 Final Report, Oct. 1970 - Jun. 1973
30 Jun. 1973 310 p refs 11 Vol.
(Contract NAS9-11330)
(NASA-CR-128994; LMSC-A991396-Vol-3) Avail: NTIS HC $17.50 CSCL 22B

The evaluation of candidate cryogenic fuel systems for space shuttle vehicles is discussed. A set of guidelines was used to establish a matrix of possible combinations for the integration of potential cryogenic systems. The various concepts and combinations which resulted from the integration efforts are described. The parameters which were considered in developing the matrix are: (1) storage of cryogenic materials, (2) fuel lines, (3) tank pressure control, (4) thermal control, (5) fluid control, and (6) fluid conditioning. Block diagrams and drawings of the candidate systems are provided. Performance predictions for the systems are outlined in tables of data. Author

N73-27753*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLIGHT TEST RESULTS FROM THE CV990 SIMULATED SPACE SHUTTLE DURING UNPOWERED AUTOMATIC APPROACHES AND LANDINGS
Frederick G. Edwards and John D. Foster Aug. 1973 43 p refs
(NASA-TM-X-62285) Avail: NTIS HC $4.25 CSCL 22B

Unpowered automatic approaches and landings with a CV990 aircraft were conducted to study navigation, guidance, and control problems associated with terminal area approach and landing for the space shuttle. The flight tests were designed to study from 11,300 m to touchdown the performance of a navigation and guidance concept which utilized blended radio/inertial navigation using VOR, DME, and ILS as the ground navigation aids. In excess of fifty automatic approaches and landings were conducted. Preliminary results indicate that this concept may provide sufficient accuracy to accomplish automatic landing of the shuttle orbiter without air-breathing engines on a conventional size runway. Author

N73-27754# Joint Publications Research Service, Arlington, Va.
ORBITAL STATIONS AND THE STUDY OF EARTH FROM SPACE
B. N. Petrov 30 Jul. 1973 25 p refs Transl. into ENGLISH from Upr. Kosmose (Moscow), v. 1, 1972 p 7-22
(JPRS-59650) Avail: NTIS HC $3.25

A discussion of new prospects for studying from space the earth's resources, the ocean, the upper atmosphere of the earth and meteorological and hydrological processes is presented. Space experiments which have led to the establishment of orbital space stations are discussed. Current efforts to design, launch, and establish space stations are reported. Author

N73-27755*# Boeing Co., Houston, Tex.
THE ANALYSIS OF THE TRANSIENT PRESSURE RESPONSE OF THE SHUTTLE EPS-ECS CRYOGENIC TANKS WITH EXTERNAL PRESSURIZATION SYSTEMS Final Report
J. E. Barton and H. W. Patterson 29 Jun. 1973 48 p refs
(Contract NAS9-12977)
(NASA-CR-133962; D2-118463) Avail: NTIS HC $4.50 CSCL 22B

An analysis of transient pressures in externally pressurized cryogenic hydrogen and oxygen tanks was conducted and the effects of design variables on pressure response determined. The analysis was conducted with a computer program which solves the compressible viscous flow equations in two-dimensional regions representing the tank and external loop. The external loop volume, thermal mass, and heat leak were the dominant design variables affecting the system pressure response. No significant temperature stratification occurred in the fluid contained in the tank. Author

N73-27756*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
SHUTTLE CRYOGENIC SUPPLY SYSTEM OPTIMIZATION STUDY. VOLUME 1: MANAGEMENT SUPPLY, SECTIONS 1 - 3 Final Report, Oct. 1970 - Jun. 1973
30 Jun. 1973 74 p refs
(Contract NAS9-11330)
(NASA-CR-128992; LMSC-A991396-Vol-1) Avail: NTIS HC $5.75 CSCL 22B

An analysis of the cryogenic supply system for use on space shuttle vehicles was conducted. The major outputs of the analysis are: (1) evaluations of subsystem and integrated system concepts, (2) selection of representative designs, (3) parametric data and sensitivity studies, (4) evaluation of cryogenic cooling in environmental control subsystems, and (5) development of mathematical model. Author

N73-27757*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
SHUTTLE CRYOGENIC SUPPLY SYSTEM OPTIMIZATION STUDY. VOLUME 5A-1: USERS MANUAL FOR MATH MODELS Final Report, Oct. 1970 - Jun. 1973
30 Jun. 1973 212 p refs
(Contract NAS9-11330)
(NASA-CR-133953; LMSC-A991396-Vol-5A-1) Avail: NTIS HC $12.75 CSCL 22B

The Integrated Math Model for Cryogenic Systems is a flexible, broadly applicable systems parametric analysis tool. The program will effectively accommodate systems of considerable complexity involving large numbers of performance dependent variables such as are found in the individual and integrated cryogen systems. Basically, the program logic structure pursues an orderly

progression path through any given system in much the same fashion as is employed for manual systems analysis. The system configuration schematic is converted to an alpha-numeric formatted configuration data table input starting with the cryogen consumer and identifying all components, such as lines, fittings, and valves, each in its proper order and ending with the cryogen supply source assembly. Then, for each of the constituent component assemblies, such as gas generators, turbo machinery, heat exchangers, and accumulators, the performance requirements are assembled in input data tabulations. Systems operating constraints and duty cycle definitions are further added as input data coded to the configuration operating sequence. Author

N73-27758*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
SHUTTLE CRYOGENIC SUPPLY SYSTEM OPTIMIZATION STUDY. VOLUME 5A-2: USERS MANUAL FOR SPACE SHUTTLE ORBIT INJECTION SYSTEM ANALYSIS (SOPSA) Final Report, Oct. 1970 - Jun. 1973
30 Jun. 1973 103 p refs
(Contract NAS9-11330)
(NASA-CR-133954; LMSC-A991396-Vol-5A-2) Avail: NTIS HC $7.25 CSCL 22B

SOPSA (Shuttle Orbit Injection Propulsion System Analysis) is a computer program to aid in the preliminary design of propellant feed systems for the space shuttle orbiter main engines. The primary purpose of the program is to evaluate propellant tank ullage pressure requirements imposed by the need to accelerate propellants rapidly during the engine start sequence. These requirements can influence the system design for a given engine as well as the suitability of a given system for use with different engines. During the vehicle design phase, the SOPSA program is used to establish feed system weight variations as a function of nominal line diameter and component and line configurations. The weight data are used in conjunction with pertinent cost data to establish optimum feed system designs. Author

N73-27759# Joint Publications Research Service, Arlington, Va.
SOLID FUEL BALLISTIC MISSILE DESIGN
A. M. Sinyukov 18 May 1973 31 p Transl. into ENGLISH from the book "Ballisticheskaya Raketa na Tverdom Toplive" Moscow, 1972
(JPRS-59060) Avail: NTIS HC $3.75

The problems of ballistic design of solid propellant missiles are discussed. Typical designs of solid propellant guided ballistic missiles and methods of calculating the elements of their trajectories in application to problems of ballistic design are presented. Information is developed on the physico-mechanical characteristics of solid propellants and materials used for the manufacture of structural parts. The reliability of solid propellant missiles and statistical evaluation of their reliability, as well as problems related to the testing of solid propellant missile constructions are examined. Author

N73-27760*# Teledyne Brown Engineering, Huntsville, Ala.
SKYLAB EXPERIMENT PERFORMANCE EVALUATION MANUAL. APPENDIX T: EXPERIMENT T027/S073 CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ZODIACAL LIGHT (MSFC)
J. E. Meyers Jul. 1973 275 p refs
(Contract NAS8-21804)
(NASA-CR-61386) Avail: NTIS HC $15.75 CSCL 22C

A series of analyses for Experiment T027/S073, contamination measurement, photometer and gegenschein/zodiacal light (MSFC), to be used for evaluating the performance of the Skylab corollary experiments under preflight, inflight, and post-flight conditons is presented. Experiment contingency plan workaround procedure and malfunction analyses are presented in order to assist in making the experiment operationally successful. Author

N73-27761*# Wisconsin Univ., Madison. Space Science and Engineering Center.
STUDIES OF SOUNDINGS AND IMAGINGS MEASUREMENTS FROM GEOSTATIONARY SATELLITES Quarterly Report, 1 Feb. - 30 Apr. 1973
Verner E. Suomi May 1973 24 p
(Contract NAS5-21798)
(NASA-CR-132799; QR-3) Avail: NTIS HC $3.25 CSCL 03B

Soundings and imaging measurements from geostationary satellites are presented. The subjects discussed are: (1) meteorological data processing techniques, (2) sun glitter, (3) cloud growth rate study, satellite stability characteristics, and (4) high resolution optics. The use of perturbation technique to obtain the motion of sensors aboard a satellite is described. The most conditions, and measurement errors. Several performance evaluation parameters are proposed. Author

N73-27762# National Oceanic and Atmospheric Administration, Boulder, Colo.
A PLASMASPHERE SOUNDER SATELLITE
W. Calvert, J. R. McAfee, R. B. Norton, T. L. Thompson, J. M. Warnock, and E. C. Whipple May 1972 28 p refs
(NOAA-TR-ERL-242-AL-8) Avail: SOD HC $0.55

A radio sounder satellite for determining the position, magnitude, and abruptness of the plasmapause for an appreciable fraction of the orbit is described. The sounder would also determine the detailed structure of the plasmasphere during entry and exit phases of the orbit. A mathematical model is developed to show the capability of the sounder in terms of range from which sufficiently strong echoes can be received. Diagrams of the orbit of the satellite are provided. Author

N73-27763*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SEMI-ANALYTICAL METHOD OF COMPUTATION OF OCEANIC TIDAL PERTURBATIONS IN THE MOTION OF ARTIFICIAL SATELLITES
Peter Musen Jul. 1973 23 p refs
(NASA-TM-X-66298; X-590-73-190) Avail: NTIS HC $3.25 CSCL 22C

The method of expansion of the satellite's perturbations, as caused by the oceanic tides, into Fourier series is discussed. The coefficients of the expansion are purely numerical and peculiar to each particular satellite. Such a method is termed as semi-analytical in celestial mechanics. Gaussian form of the differential equations for variation of elements, with the right hand sides averaged over the orbit of the satellite, is convenient to use with the semi-analytical expansion. Author

N73-27764*# Stanford Research Inst., Menlo Park, Calif.
CONTINUED INVESTIGATION OF SOLID PROPULSION ECONOMICS. TASK 1B: LARGE SOLID ROCKET MOTOR CASE FABRICATION METHODS - SUPPLEMENT PROCESS COMPLEXITY FACTOR COST TECHNIQUE
John Baird Aug. 1967 38 p
(Contract NAS7-309; SRI Proj. MU-5139)
(NASA-CR-133412) Avail: NTIS HC $4.00 CSCL 22B

This supplement to Task IB-Large Solid Rocket Motor Case Fabrication Methods supplies additional supporting cost data and discusses in detail the methodology that was applied to the task. For the case elements studied, the cost was found to be directly proportional to the Process Complexity Factor (PCF). The PCF was obtained for each element by identifying unit processes that are common to the elements and their alternative manufacturing routes, by assigning a weight to each unit process, and by summing the weighted counts. In three instances of actual manufacture, the actual cost per pound equaled the cost estimate based on PCF per pound, but this supplement, recognizes that the methodology is of limited, rather than general, application. Author

N73-27765# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
EUROPEAN SPACE TUG. PHASE A STUDY: COMPREHENSIVE TUG CONCEPTS SIZE AND SYSTEMS ANALYSIS VS. MISSION REQUIREMENT MODEL COVERAGE AND PROGRAM COST, VOLUME 2, SUMMARY PART 1 Final Report
May 1972 68 p Prepared jointly with Brit. Aircraft Corp., Construcciones Aeron., Compagn. Ind. Radioelectrique, Eidgenoess. Flugzeugwerke, Etudes Tech. et Construct. Aerospatiales, Marconi Space and Defence Systems, Selenia, Soc. Natl. Ind. Aerospatiale
(Contract ELDO-CTR-17/4/64)
(MBB-URV-53-72-Vol-2-Pt-1) Avail: NTIS HC $5.50

The results are given of a size and system analysis versus mission requirement, model coverage, and program cost for different space tug concepts. The pre-phase A studies have led to the selection of a single stage, ground based space tug concept. The mission requirements, the mission model and the cost elements defined in the USA for the space shuttle system, have served as a basis for this optimization. Tug system and size definition, different tug concept system performance and operation modes, mission coverage for the elaborated mission model, and fleet size evaluations, as well as the cost of each type of operation and the total costs were considered. The conclusions of the study show that the single stage largest size space tug remains the optimum solution, but the propellant mass fraction must be an average of 0.9. A second optimum solution could be achieved with a small stage plus an expendable auxiliary tank. ESRO

N73-27766# Reusser (Peter) A.G., Zurich (Switzerland).
DEVELOPMENT OF A HIGH PERFORMING ACTUATION SYSTEM FOR A LOUVER ARRAY FOR SATELLITE THERMAL CONTROL
P. U. Reusser, J. A. F. Coebergh, and J. Meister 17 Apr. 1973 81 p refs
(Contract ESTEC-1550-71-HP)
(ESRO-CR(P)-247) Avail: NTIS HC $6.25

To meet more demanding thermal requirements of advanced spacecrafts, a high performing actuation system was developed to drive one pair, or a set of nine pairs, of louver blades. Under simulated space conditions, this successfully tested actuation system was compared with a bimental actuator. Performance limitations of the bimetal actuator are: sensitivity limited to 3 C; delta T range between fully opened and closed positions of the blades be 15 C or more; no possibility of controlling hot spots; and long time constant. A new actuation system was developed with improved performances.
Author (ESRO)

N73-27767# Saab-Scania, Linkoping (Sweden). Missile and Electronics Section.
DETERMINATION OF REALISTIC DISTURBANCE TORQUE PARAMETERS USING ESRO 1A DATA
Bengt Schmidtbauer Dec. 1972 93 p refs
(Contract ESOC-327/71/AR)
(RA-SAT-3.4-C-006; ESRO-CR(P)-248) Avail: NTIS HC $6.75

A mathematical model is derived for the attitude dynamics of a satellite (ESRO 1A) with passive magnetic stabilization. The key parameters of this model are numerically identified through suitable processing of existing attitude sensor measurement records. The parameter estimates, showing a reasonable degree of consistency for data from different orbits, indicate a significant rotation (approximately equal to 15 deg) of the principal inertia axes with respect to the satellite axis of symmetry and a misalignment (approximately equal to 1 deg) of the effective permanent magnet direction. Intermediary results are verifed by deriving theoretical models of the attitude measurement (Quantization) errors and investigating their propagation through processing (smoothing and differentiation) routines. The use of the derived dynamic model for various practical applications is discussed. Author (ESRO)

N73-27768# European Space Research and Technology Center, Noordwijk (Netherlands). Aeronautical Program Office.
MAJOR FACTORS INFLUENCING THE DESIGN OF AN AEROSAT SYSTEM FOR EVALUATION
J. A. Vanderkerckhove Mar. 1973 17 p ref Presented at the Intern. Conf. on Satellite Systems for Mobile Commun. and Surveillance, London, 13-15 Mar. 1973
Avail: NTIS HC $3.00

The major tradeoffs affecting the design of a first generation AEROSAT system compatible with the capability of the Delta launcher are discussed. They include the spacecraft platform design, coverage, power requirements, return channels, payloads, and surveillance. ESRO

N73-27769# Aerospace Corp., El Segundo, Calif.
MISSION PLANNING PROGRAM (MPP) USAGE GUIDE Research Report, Oct. 1972 - Mar. 1973
W. D. Downs, III, R. H. Prislin, and W. F. Rearick 15 Mar. 1973 120 p refs
(Contract F04701-72-C-0073)
(AD-760796; TR-0073(9320)-2; SAMSO-TR-73-172) Avail: NTIS CSCL 17/8

The Mission Planning Program (MPP) was developed by The Aerospace Corporation to solve ground-station-to-satellite visibility problems. Although it was written specifically for the CDC 6000/7000 series computers, there are no restrictions relative to hardware configuration or operating system interfaces. This document is intended to serve an an input usage guide; it describes program capabilities and defines all input required to perform MPP functions. Author (GRA)

N73-27770# United Technology Center, Sunnyvale, Calif.
FABRICATE AND DELIVER 100 SHEAR SPUN MOTOR CASES Final Report, 7 Jun. 1972 - 6 Jun. 1973
F. L. Banta, J. G. Hill, and D. J. Trimble 6 Jun. 1973 34 p
(Contract DAAH01-72-C-0928)
(AD-761129; UTC-2456-FR) Avail: NTIS CSCL 19/7

One hundred (100) small diameter rocket motor cases were fabricated hydrotested, and delivered for testing. These motor cases (nominally 2.854-inches O. D. by 0.060-inch wall by 7.340-inches long) were cold shear spun from 3.940-inch long preforms of annealed 300 grade maraging steel per MIL-S-46850. After shear spinning, the cases were machined to U. S. Army Missile Command Drawing No. RK 570. Fabrication parameters were developed and all motor cases were hydro-proof tested to 8,300 psig. Author (GRA)

N73-27771# Harry Diamond Labs., Washington, D.C.
THE RESULTS OF THE LANCE CABLE TESTS
Robert F. Gray Jan. 1973 15 p
(HDL Proj. X512F3; DA Proj. 1W0-62118-AD-51)
(AD-761078; HDL-TM-72-32) Avail: NTIS CSCL 09/1

A series of cable driver tests were conducted on available LANCE umbilical cables to determine the shielding effectiveness of the exterior shield and connector assemblies. Corrective recommendations are made for the deficiencies that the tests revealed in the cable/connector assemblies. Author (GRA)

N73-27772*# ARO, Inc., Arnold Air Force Station, Tenn.
HEAT TRANSFER AND FLOW FIELD TESTS OF THE MCDONNELL DOUGLAS - MARTIN MARIETTA SPACE SHUTTLE CONFIGURATIONS Final Report, Jun. 1971 - Jan. 1972
R. K. Matthews, R. H. Eaves, Jr., and W. R. Martindale AEDC Apr. 1973 107 p refs Sponsored by NASA
(NASA-CR-133405; AD-759176; ARO-VKF-TR-72-124; AEDC-TR-73-53) Avail: NTIS HC $7.50 CSCL 22/2

Aerothermodynamic tests of Phase B space shuttle configurations proposed by McDonnell Douglas--Martin Marietta were conducted at Mach numbers 8 and 10.5. Test conditions provided both Mach number and Reynolds number simulation for typical ascent and reentry trajectories. This report provides a comprehensive analysis of the major test results and also presents data comparisons with theoretical calculations. Specific areas covered are ascent heating and shock interference, booster reentry heating and flow fields, and orbiter reentry analysis which includes leeside heating, windward shock angles and flow fields, windward surface heating, and boundary-layer transition. Author (GRA)

N73-27773*# ARO, Inc., Arnold Air Force Station, Tenn.
NASA-CONVAIR ACS SPACE SHUTTLE STUDY AT MACH NUMBER 8.0 Final Report
W. T. Strike, Jr. and J. T. Best, Jr. AEDC May 1973 161 p refs Sponsored in part by NASA
(NASA-CR-133407; AEDC-TR-73-40; AD-759578; ARO-VKF-TR-72-140) Avail: NTIS HC $10.25 CSCL 22/2

Some aerothermodynamic design problems of the Space Shuttle attitude control system (ACS) were experimentally studied in a series of tests conducted at Mach number 8, at Reynolds numbers of 1,000,000 and 5,000,000, using a flat plate containing interchangeable, flush-mounted nozzle cavities and lateral jet nozzles. The ACS configurations considered in this test program were a single supersonic nozzle and a cluster of four symmetrically located supersonic nozzles. Also, some preliminary results were obtained with nozzles similar to those on the flat plate used to simulate the yaw controls on a

2-percent-scaled nose section of the Convair Aerospace B-9U booster. (Author Modified Abstract) GRA

N73-27774# Hercules, Inc., Cumberland, Md. Allegany Ballistics Lab.
MANUFACTURE AND DELIVERY OF COMPOSITE MOTOR CASES, VOLUME 1 Final Report, 8 May 1972 - 30 Apr. 1973
Roger J. Dale Apr. 1973 231 p
(Contract DAAH01-72-C-0829)
(AD-760566) Avail: NTIS CSCL 19/7

The report covers the design, fabrication, experimental design verification, manufacture and delivery of 20 fiberglass and 20 PRD-49 Type III three-inch diameter composite rocket motor cases for application to SMAWT (Short Range Man Portable Anti-Tank Weapons Technology). Both motor case designs had open aft ends to permit propellant to be cast and case bonded to the case wall or the insertion and bonding of a cartridge-loaded grain. Author (GRA)

N73-27775# Hercules, Inc., Cumberland, Md. Allegany Ballistics Lab.
MANUFACTURE AND DELIVERY OF COMPOSITE MOTOR CASES, VOLUME 2 Final Report, 8 May 1972 - 30 Apr. 1973
Roger J. Dale Apr. 1973 156 p
(Contract DAAH01-72-C-0829)
(AD-760569) Avail: NTIS CSCL 19/7

Contents: Design calculations; Case sketches; Tooling sketches; Manufacturing and inspection records. GRA

N73-27817* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE OSO-7 MISSION
John M. Thole *In its* Significant Accomplishments in Technol., 1972 1973 p 7-10 (For availability see N73-27816 18-34) CSCL 22B

N73-27818* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DELTA VEHICLE IMPROVEMENTS
Robert J. Goss *In its* Significant Accomplishments in Technol., 1972 1973 p 11-13 (For availability see N73-27816 18-34) CSCL 22B

N73-27825* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GRAVITY-GRADIENT DYNAMICS EXPERIMENTS PERFORMED IN ORBIT UTILIZING THE RADIO ASTRONOMY EXPLORER (RAE-1) SPACECRAFT
Harvey Walded *In its* Significant Accomplishments in Technol., 1972 1973 p 32-36 (For availability see N73-27816 18-34) CSCL 22B

N73-27828* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SECONDARY MIRROR SUPPORT (LST)
Edward E. Schmidt *In its* Significant Accomplishments in Technol., 1972 1973 p 45-48 (For availability see N73-27816 18-34) CSCL 22B

N73-27837* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GSFC COSMIC RADIATION EXPERIMENT FOR THE PIONEER F/G JUPITER MISSION
James H. Trainor *In its* Significant Accomplishments in Technol., 1972 1973 p 82-85 (For availability see N73-27816 18-34) CSCL 22B

N73-27838* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE INTERNATIONAL ULTRAVIOLET EXPLORER
Albert Boggess *In its* Significant Accomplishments in Technol., 1972 1973 p 86-88 (For availability see N73-27816 18-34) CSCL 22B

N73-27845* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RESULTS OF MARINER MARS TRACKING CALIBRATION EXPERIMENT
James W. Ryan *In its* Significant Accomplishments in Technol., 1972 1973 p 121-124 (For availability see N73-27816 18-34)
CSCL 22B

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N73-27776 National Lending Library for Science and Technology, Boston Spa (England).
FATIGUE INVESTIGATIONS UNDER COMBINED STRESSES
L. Dietrich and K. Turski Feb. 1973 30 p refs Transl. into ENGLISH from Mech. Teor. Stosow. (Poland), v. 10, no. 1, 1972 p 9-28
(NLL-RTS-7770) Avail: Natl. Lending Library, Boston Spa, Engl.: £2.90; 2 NLL photocopy coupons

Experimental investigations of fatigue fracture under combined stresses are reported. The results are developed according to the shape of the specimen. The equations for the fatigue conditions are included. Author

N73-27777 National Lending Library for Science and Technology, Boston Spa (England).
THE USE OF THE MOIRE METHOD IN THE INVESTIGATION OF SHEET FLATNESS
P. I. Denisov, S. A. Tulupov, M. G. Polyakov, V. A. Bobylev, and A. N. Vdovenko [1973] 9 p refs Transl. into ENGLISH from Izv. vysshikh Uchebn. Zavedenii, Chernaya Met. (Moscow), v. 11, 1972 p 71-73
(NLL-M-21611-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The formation of longitudinal edge waviness and center camber on sheet metals as a function of transverse elongation homogeneity is discussed. The flatness of the sheet is determined by using the moire band fields on specimens without mirror finish surfaces. The longitudinal and transverse camber distributions in the sheet are calculated from the field of each deformed specimen. The experimental data are compared with the known graph of the critical boundaries for the formation edge waviness and camber. Author

N73-27778 Washington Univ., Seattle.
DYNAMIC FRACTURE INDUCED BY RADIAL CYLINDRICAL STRESS WAVE PROPAGATION Ph.D. Thesis
Robert Max Schmidt 1972 101 p
Avail: Univ. Microfilms Order No. 73-3783

An experiment investigating dynamic fracture in aluminum alloys using radial cylindrical wave propagation is presented. A cylindrical fracture surface is generated in an annular specimen subject to the plane strain loading of a concentrically located exploding wire. The effect of plastic strain history is shown to be negligible invalidating the theory that the time dependent character of dynamic fracture is due to a limiting dislocation velocity. In its place, a hypothesis which attributes the time dependency to a limiting crack velocity and the stress dependency to a hierarchy of nucleation sites whose number density increases with increased applied stress level is shown to be applicable. The results from the cylindrical experiments, when compared with those from a different goemetric configuration, suggests a more general criterion for dynamic fracture. Dissert. Abstr.

N73-27779 Lehigh Univ., Bethlehem, Pa.
EXTREMELY LOW FATIGUE CRACK PROPAGATION Ph.D. Thesis
Roger Ainsworth Schmidt 1972 96 p
Avail: Univ. Microfilms Order No. 73-4281

The threshold in the alternating range of stress intensity factor for extremely slow fatigue crack growth is investigated

for 2024-T3 aluminum and Ti-6Al-4V titanium alloy. A special fatigue frame constructed for use with an electrodynamic shaker table provided displacement control at frequencies up to 1000 cps. The threshold for 2024-T3 aluminum is seen to decrease with increasing frequency at a fixed load ratio, dropping by nearly a factor of 2 from 342 cps to 832 cps. The threshold is also observed to decrease with increasing load ratio in such a way that is tentatively explained by considerations of crack closure. Some confirmation of this is obtained from direct strain gage measurement of the closure stress intensity, which agrees with that predicted from trends in the threshold data with respect to load ratio. Dissert. Abstr.

N73-27780# Aeronautical Research Labs., Melbourne (Australia).

THE INFLUENCE OF REPEATED SOLUTION TREATMENT AND AGEING CYCLES ON THE FATIGUE STRENGTH OF L65 ALUMINUM ALLOY

J. Y. Mann Dec. 1972 19 p refs

(ARL/SM-Note-386) Avail: NTIS HC $3.00

Axial load fatigue tests were carried out on unnotched specimens taken from L65 aluminum alloy extrusions which had been subjected to up to three standard solution treatment and precipitation aging cycles. Although repeated solution treatment and aging did not affect the fatigue strength, the surface oxide film formed during solution treatment was found to cause a reduction in fatigue strength of up to 20 percent. Author

N73-27781# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.

FUNDAMENTAL RESEARCH ON STRESS WAVE EMISSION METHOD FOR PRESSURE VESSELS

Hajime Hatano, Ryo Horiuchi, and Noboru Niwa May 1973 11 p refs

(ISAS-492) Avail: NTIS HC $3.00 CSCL 20K

Fundamental research for the application of the stress wave emission method to nondestructive inspection and safety monitoring of structures is carried out experimentally. Firstly, stress wave emission of a model pressure vessel is observed during hydrostatic testing. Time differences in stress-wave emission signals are measured between four sensors attached to the surface of the vessel wall. Stress wave emission that is radiated at pressures lower than the proof pressure is due to the structual imperfection which is liable to cause a fracture. Secondly, low cycle fatigue testing of a model pressure vessel is monitored using a single channel system simplified for practical use. During the 1st pressure cycle, a large amount of stress wave emission is recorded at high pressures. From the 2nd to about the 5300th cycle, scarcely any stress wave emission is detected. The usefulness of this method to predict the fatigue failure of the vessels in service is shown. Thirdly, it is observed that a full-size titanium-alloy rocket chamber under hydrostatic testing emits very large stress waves on account of twinning of the material. The Stress Wave emission method is demonstrated to have a potential value for nondestructive testing and safety monitoring of pressure vessels. Author

N73-27782# Defence Research Establishment Valcartier (Quebec).

ON THE PREDICTION OF CRATER PROFILES PRODUCED IN DUCTILE TARGETS BY THE IMPACT OF RIGID PENETRATORS AT BALLISTIC VELOCITIES

P. N. Brooks Jan. 1973 73 p refs

(DREV-R-686/73) Avail: NTIS HC $5.75

The penetration and cratering process for non-deforming projectiles impacting ductile targets is modeled analytically on the basis of an aerodynamic analogy involving a rigid-plastic atmosphere. A set of coefficients is determined which can be used to predict the behaviour of cylindrical projectiles having tips that are either purely conical or comprised of two conical sections. Comparisons made with experiment show good agreement for a variety of projectile/target combinations and demonstrate that the model can be used to optimize the design of a penetrator for a specific velocity range and target material. Author

N73-27783*# Virginia Univ., Charlottesville.

PERFORM - A PERFORMANCE OPTIMIZING COMPUTER PROGRAM FOR DYNAMIC SYSTEMS SUBJECT TO TRANSIENT LOADINGS

W. D. Pilkey, B. P. Wang, Y. Yoo, and B. Clark Washington NASA Jun. 1973 232 p refs

(Grant NGR-47-005-145)

(NASA-CR-2268; AEEP-4085-105-71U) Avail: NTIS HC $3.00 CSCL 20K

A description and applications of a computer capability for determining the ultimate optimal behavior of a dynamically loaded structural-mechanical system are presented. This capability provides characteristics of the theoretically best, or limiting, design concept according to response criteria dictated by design requirements. Equations of motion of the system in first or second order form include incompletely specified elements whose characteristics are determined in the optimization of one or more performance indices subject to the response criteria in the form of constraints. The system is subject to deterministic transient inputs, and the computer capability is designed to operate with a large linear programming on-the-shelf software package which performs the desired optimization. The report contains user-oriented program documentation in engineering, problem-oriented form. Applications cover a wide variety of dynamics problems including those associated with such diverse configurations as a missile-silo system, impacting freight cars, and an aircraft ride control system. Author

N73-27784*# Materials Sciences Corp., Blue Bell, Pa.

AN INVESTIGATION OF THE COMPRESSIVE STRENGTH OF PRD-49-3/EPOXY COMPOSITES Final Report

Satish V. Kulkarni, Joseph S. Rice, and B. Walter Rosen Jun. 1973 93 p refs

(Contract NAS1-11780)

(NASA-CR-112334) Avail: NTIS HC $6.75 CSCL 20K

The development of unidirectional fiber composite materials is discussed. The mechanical and physical properties of the materials are described. Emphasis is placed in analyzing the compressive behavior of composite materials and developing methods for increasing compressive strength. The test program for evaluating the various procedures for improving compressive strength are reported. Author

N73-27785# Lockheed Missiles and Space Co., Palo Alto, Calif.

STABILITY OF AXIALLY COMPRESSED CYLINDRICAL SHELLS FROM COMPOSITE MATERIALS UNDER NON-STATIONARY HEATING

L. G. Belozerov and V. A. Kireev [1973] 10 p refs Transl. into ENGLISH from Mekhan. Polimerov, Akad. Nauk Latv. SSR (Riga), no. 2, 1973 p 289-297

Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The problem of buckling of uniformly compressed smooth cylindrical shells from ccomposite materials under nonstationary heating is solved in a linear quasi-static formulation. Computational formulas are obtained to determine the critical loads and their domains of application. Results of a computation are compared with experimental data obtained during linear-law heating of the outer surface of axially compressed smooth cylindrical shells from fiberglass using a phenol-formaldehyde binder. Author

N73-27786*# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.

THEORETICAL ANALYSIS OF IMPACT IN COMPOSITE PLATES

Francis C. Moon [1973] 100 p refs

(Contract NAS3-14331)

(NASA-CR-121110; AMS-1099) Avail: NTIS HC $7.00 CSCL 20K

The calculated stresses and displacements induced anisotropic plates by short duration impact forces are presented. The theoretical model attempts to model the response of fiber composite turbine fan blades to impact by foreign objects such as stones and hailstones. In this model the determination of the impact force uses the Hertz impact theory. The plate response treats the laminated blade as an equivalent anisotropic material using a form of Mindlin's theory for crystal plates. The analysis

makes use of a computational tool called the fast Fourier transform. Results are presented in the form of stress contour plots in the plane of the plate for various times after impact. Examination of the maximum stresses due to impact versus ply layup angle reveals that the + or - 15 deg layup angle gives lower flexural stresses than 0 deg, + or - 30 deg and + or - 45 deg. cases. Author

N73-27787# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STATISTICAL PROPERTIES OF THE LOAD-CARRYING CAPACITY OF SMOOTH CYLINDRICAL SHELLS
L. I. Manevich and E. F. Prokopalo 16 May 1973 13 p refs Transl. into ENGLISH from the Mono. "Problemy Nadezhnosti v Stroitelandi Mekhanike" USSR, Jun. 1968 p 182-187
(AD-760946; FTD-HT-23-235-73) Avail: NTIS CSCL 20/11

The report is devoted to an experimental investigation of the stability of cylindrical shells under axial compression and internal pressure. A statistical analysis of the critical loads is presented. Author (GRA)

N73-27788# California Univ., Berkeley. Structural Engineering Lab.
IDENTIFICATION OF NONLINEAR MATERIALS BY FINITE ELEMENT METHODS Final Report
Jan. 1973 199 p refs
(PB-219090/8; UC-SESM-73-4) Avail: NTIS HC $3.00 CSCL 20K

A method is developed to identify nonlinear material behavior. Discussed are the types of functionals that characterize various classes of nonlinear thermomechanical materials, the types of experiments needed to generate data capable of identifying nonlinear material constitutive functionals, and the inverse boundary value problem that models the identification problem. A new technique of material parameterization that uses finite elements defined over the multi-dimensional domain of the material operator is found to give very useful results. The identification problem is expressed as a system of nonlinear algebraic equations that couples the set of experimentally observed measurements and the discretized boundary value problem. A computer program is developed for the special case of isotropic, incompressible elastic materials. A wide range of numerical examples is studied to determine the accuracy and stability of this material identification algorithm. Author (GRA)

N73-27789# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
STRENGTHENING OF KEYED LONGITUDINAL CONSTRUCTION JOINTS IN RIGID PAVEMENTS Technical Report, Jan. 1971 - Jul. 1972
R. W. Grau Mar. 1973 129 p refs Sponsored in part by FAA
(Contract F30602-70-X-0010; AF Proj. 683M)
(AD-759570; AFWL-TR-72-174) Avail: NTIS CSCL 13/2

The rigid pavement test section was constructed of portland cement concrete (PCC) and trafficked with a 360-kip 12-wheel assembly and a 166-kip twin-tandem assembly to evaluate the performance of keyed and doweled longitudinal construction joints in rigid airfield pavements under multiple-wheel heavy gear loadings (MWHGL) and to investigate the feasibility of strengthening existing keyed longitudinal construction joints. (Author Modified Abstract) GRA

N73-27790# Ballistic Research Labs., Aberdeen Proving Ground, Md.
COALESCENCE OF CAVITIES DURING DYNAMIC FRACTURE
William S. DeRosset Jan. 1973 30 p refs
(DA Proj. 1T0-61101-A-91A; DA Proj. 1W0-62113-A-660)
(AD-761082; BRL-1631) Avail: NTIS CSCL 20/12

Two different modeling schemes have been used to predict the effect of coalescence on the observed growth laws of cavities during dynamic fracture. The first approach describes the coalescence problem 13 as a set of coupled equations. A simple physical model is proposed for which these equations can be solved analytically. Experimental data on void growth in aluminum during dynamic fracture are seen to fit the growth law predicted by the model. The second approach uses a computer simulation of cavity coalescence. Using true nucleation and growth laws which are linear in time, this particular simulation predicts that the observed growth rate will be exponential in time.
Author (GRA)

N73-27791# Watervliet Arsenal, N.Y.
K CALIBRATION FOR C SHAPED FRACTURE TOUGHNESS SPECIMENS OF VARIOUS GEOMETRIES
J. H. Underwood, R. D. Scanlon, and D. P. Kendall Apr. 1973 26 p refs
(AD-761102; R-WV-T-6-15-73) Avail: NTIS CSCL 20/11

Prior collocation results are combined with new collocation data and analyzed using two parameter data approximation methods and fracture mechanics methods. A general K calibration is obtained for C shaped specimens which have outer to inner radius ratios, W = r sub 2/r sub 1, between 1.4 and 2.5. The K calibration for C shaped specimens is found to depend on the load eccentricity to specimen thickness ratio, x/t, as well as the usual crack depth to specimen thickness ratio, a/t. The K results are presented as tabular and plotted values from a cubic spline surface used to approximate the collocation data and as a polynomial approximation of the collocation data over a more limited range of x/t. (Author Modified Abstract) GRA

N73-27792# Naval Postgraduate School, Monterey, Calif.
NATURAL MODES AND FREQUENCIES OF FREE VIBRATION OF SHELLS OF REVOLUTION: ANALYSIS OF A SHELL OF LINEARLY VARYING THICKNESS. SATANS-3: THEORY AND USER'S MANUAL M.S. Thesis
Ralph Robert Nebiker Mar. 1973 304 p refs
(AD-761370) Avail: NTIS CSCL 20/11

A digital computer program known as SATANS-III is developed as a modification to the program SATANS-1, incorporating the capability to perform free vibration analyses for the natural frequencies and modes of thin, elastic shells of revolution. The geometric and material properties of the shell may vary along the meridian. SATANS-III retains the SATANS-I capability of performing geometrically nonlinear static and dynamic analyses of arbitrarily loaded shells. The free vibration analysis employs the inverse iteration method with spectral shifts, including the capability to search a specific range of frequencies. Several example problems are solved to illustrate the program's validity and accuracy. A user's manual for SATANS-III is presented. (Author Modified Abstract) GRA

N73-27793# Naval Ship Research and Development Center, Bethesda, Md.
COMPUTER-AIDED INPUT/OUTPUT FOR THE USE WITH FINITE ELEMENT STRUCTURAL ANALYSES Final Report
Robert D. Rockwell Feb. 1973 84 p
(AD-761154; NSRDC-3844) Avail: NTIS CSCL 09/2

The enormous computational ability of modern computers has encouraged development of the finite element method of structural analysis. However, preparation of the large amount of input data and interpretation of the large amount of output data generated by the method can be very time consuming and costly. Accordingly, it is desirable to automate both the preparation and interpretation of data insofar as possible. The report describes three FORTRAN CDC 6700 computer programs that were developed for this purpose, namely, GENDA, HIDE, and CONPLT. GENDA divides a three-dimensional plate and shell structure into triangular and/or rectangular elements and generates the input data required for the analysis. HIDE generates plots of the idealizations produced by GENDA in such a way that only portions of elements that can be seen from the user's viewpoint are plotted. CONPLT plots the output data in a form which can be quickly interpreted by the analyst. Some of the data formats used are compatible with NASTRAN. (Author Modified Abstract) GRA

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N73-27794 National Lending Library for Science and Technology, Boston Spa (England).
THE CALCULATION OF TEMPERATURE AND STRESSES IN A CYLINDER HEATED WITH A CONSTANT HEAT FLOW
V. M. Guba and Yu. S. Postolnik [1973] 6 p refs Transl. into ENGLISH from Izv. Vysshikh Vchebn. Zavedenii, Chernaya Met. (Moscow), v. 10, 1972 p 150-154
(NLL-M-21601-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Approximation dependences are presented for the calculation of the temperature and stresses in a holow cylinder heated under limit conditions of the second order. The process of heat conductivity is interpreted by an engineering model. Temperature functions are obtained by an integral method. A general solution is presented for the thermo-elastic problem and calculation formulas given for the limit condition of heating. Graphs are constructed for temperature and maximum stresses. Author

N73-27795 National Lending Library for Science and Technology, Boston Spa (England).
INVESTIGATION OF HEAT TRANSFER FROM A POLYDISPERSE LOOSE MATERIAL TO A TUBE SURFACE LOCATED TRANSVERSELY TO THE DIRECTION OF FLOW 2
E. N. Kryuchkov and Yu. I. Rozengart [1973] 8 p ref Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Chernaya Met. (Moscow), v. 10, 1972 p 155-157
(NLL-M-21602-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The results of an investigation into the heat exchange between a cooled polydisperse granular material and transversely located cylindrical tubes arranged in a staggered bundle are presented. An empirical heat exchange equation was obtained on the basis of experimental data. Author

N73-27796* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ABLATION ARTICLE AND METHOD Patent
Wayne D. Erickson and Edward M. Sullivan, inventors (to NASA) Issued 17 Jul. 1973 5 p Filed 20 Sep. 1971
(NASA-Case-LAR-10439-1; US-Patent-3,745,816; US-Patent-Appl-SN-182033; US-Patent-Class-73-86; US-Patent-Class-73-339; US-Patent-Class-73-432R; US-Patent-Class-356-72) Avail: US Patent Office CSCL 20M

An ablation article, such as a conical heat shield, having an ablating surface is provided with at least one discrete area of at least one seed material, such as aluminum. When subjected to ablation conditions, the seed material is ablated. Radiation emanating from the ablated seed material is detected to analyze ablation effects without disturbing the ablation surface. By providing different seed materials having different radiation characteristics, the ablating effects on various areas of the ablating surface can be analyzed under any prevailing ablation conditions. The ablating article can be provided with means for detecting the radiation characteristics of the ablated seed material to provide a self-contained analysis unit.
Official Gazette of the U.S. Patent Office

N73-27797*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HEAT FLOW AND CONVECTION DEMONSTRATION (APOLLO 14)
Tommy C. Bannister 29 Mar. 1973 139 p refs
(NASA-TM-X-64735) Avail: NTIS HC $9.00 CSCL 20M

Apollo 14 Astronaut Stuart A. Roosa conducted a group of experiments during the lunar flyback on February 7, 1971, to obtain information on heat flow and convection in gases and liquids in an environment of less than 0.000001 g. Flow observations and thermal data have shown that: (1) as expected, there are convective motions caused by surface tension gradients in a plane liquid layer with a free upper surface; (2) heat flow in enclosed liquids and gases occurs mainly by diffusive heat conduction; and (3) some convective processes, whose characteristics are not fully known, add to the heat transfer. The raw data are presented, and the analysis approach is given.
Author

N73-27798*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF TEMPERATURE DATA FROM AN ENGINE INVESTIGATION FOR FILM-COOLED AND NON-FILM-COOLED, PANWISE-FINNED VANES INCORPORATING IMPINGEMENT COOLING
Daniel J. Gauntner Washington Jul. 1973 28 p refs
(NASA-TM-X-2819; E-7386) Avail: NTIS HC $3.00 CSCL 20M

The experimental temperature characteristics of two spanwise-finned, impingement-cooled vanes, one with film cooling and one without film cooling, were investigated in a modified J-75 research turbojet engine. Values of maximum temperature, average temperature, and maximum chordwise temperature difference were compared for the two vanes at the midspan. An analytical redesign of the two vane configurations indicated that the maximum and average temperatures and the maximum chordwise temperature difference could be significantly lowered. The experimental tests indicated that suction-surface film cooling may cause increased heat transfer near the trailing edge of the vane.
Author

N73-27799*# Michigan Univ., Ann Arbor. Tire and Suspension Systems Research Group.
PRELIMINARY MEASUREMENTS ON HEAT BALANCE IN PNEUMATIC TIRES
G. H. Nybakken, D. Y. Collart, R. J. Staples, J. I. Lackey, S. K. Clark, and R. N. Dodge Jul. 1973 80 p refs
(Grant NGR-23-005-417)
(NASA-CR-121239; Rept-036390-2-T) Avail: NTIS HC $6.00 CSCL 20M

A variety of tests was undertaken to determine the nature of heat generation associated with a pneumatic tire operating under various conditions. Tests were conducted to determine the magnitude and distribution of internally generated heat caused by hysteresis in the rubber and ply fabric in an automobile tire operating under conditions of load, pressure, and velocity representative of normal operating conditions. These included tests at various yaw angles and tests with braking applied. In other tests, temperature sensors were mounted on a road to measure the effect of a tire rolling over and an attempt was made to deduce the magnitude and nature of interfacial friction from the resulting information. In addition, tests were performed using the scratch plate technique to determine the nature of the motion between the tire and road. Finally, a model tire was tested on a roadwheel, the surface covering which could be changed, and an optical pyrometer was used to measure rubber surface temperatures. Author

N73-27800*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STARTUP ANALYSIS FOR A HIGH TEMPERATURE GAS LOADED HEAT PIPE
Peter M. Sockol Washington Jul. 1973 21 p refs
(NASA-TM-X-2840; E-7416) Avail: NTIS HC $3.00 CSCL 20M

A model for the rapid startup of a high-temperature gas-loaded heat pipe is presented. A two-dimensional diffusion analysis is used to determine the rate of energy transport by the vapor between the hot and cold zones of the pipe. The vapor transport rate is then incorporated in a simple thermal model of the startup of a radiation-cooled heat pipe. Numerical results for an argon-lithium system show that radial diffusion to the cold wall can produce large vapor flow rates during a rapid startup. The results also show that startup is not initiated until the vapor pressure p sub v in the hot zone reaches a precise value proportional to the initial gas pressure p sub i. Through proper choice of p sub i, startup can be delayed until p sub v is large enough to support a heat-transfer rate sufficient to overcome a thermal load on the heat pipe. Author

N73-27801*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THERMAL CONDUCTIVITY OF PARTICULATE MATERIALS: A SUMMARY OF MEASUREMENTS TAKEN AT THE MARSHALL SPACE FLIGHT CENTER
James A. Fountain 20 Apr. 1973 72 p refs
(NASA-TM-X-64759) Avail: NTIS HC $5.75 CSCL 20M

Thermal conductivity measurements of particulate materials in vacuum are presented in summary. Particulate basalt and soda lime glass beads of various size ranges were used as samples. The differentiated line heat source method was used for the measurements. A comprehensive table is shown giving all pertinent experimental conditions. Least-squares curve fits to the data are presented. Author

N73-27802# Bureau of Mines, Pittsburgh, Pa. Mining and Safety Research Center.
CARD-GAP AND PROJECTILE IMPACT SENSITIVITY MEASUREMENTS, A COMPILATION
Richard W. Watson 1973 12 p refs
(BM-IC-8605) Avail: NTIS HC $3.00

Card-gap and projectile impact sensitiviy data are presented for a wide variety of explosive compositions tested at the Bureau of Mines in more or less standard test geometries. The results of both tests are in good agreement in that they provide the same sensitivity ordering for different subclasses of explosives. Least sensitive were homogeneous liquids that did not exhibit a tendency to undergo low-velocity detonation, ammonium nitrate-fuel oil, and most cast military explosives. Of intermediate sensitivity were pressed and powdered military explosives, cast pentolite, permissible and nonpermissible water-based explosives, and one commercial two-component explosive. The most sensitive were permissible and nonpermissible dynamites and explosives susceptible to low-velocity detonation. Author

N73-27803# Bureau of Mines, Pittsburgh, Pa. Mining and Safety Research Center.
RADICAL SPECIES PROFILES FOR A METHANE-OXYGEN-ARGON FLAME
Charles P. Lazzara, Joan C. Biordi, and John F. Papp 1973 9 p refs
(BM-RI-7766) Avail: NTIS HC $3.00

Concentration profiles of low-pressure, slightly lean Ch4-02-Ar flames were measured in situ for the following unstable species: oxygen atoms, hydrogen atom, hydroxyl radical, methyl radical, and formyl radical. The observed maximum mole fractions were 0.02 for H, 0.011 for OH, and 0.008 for O; the maxima occurred in the recombination zone. Methyl and formyl radicals have maximum mole fractions in the reaction zone of 0.0022 and 0.00006, respectively. Author

N73-27804*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TURBOJET EMISSIONS, HYDROGEN VERSUS JP
Jack Grobman, Carl Norgren, and David Anderson 1973 22 p refs Presented at Working Symp. on Liquid-HydrogenFueled Aircraft, Langley, Va., 15-16 May 1973
(NASA-TM-X-68258; E-7539) Avail: NTIS HC $3.25 CSCL 21B

Preliminary data from an experimental combustor show that the NOx emission index, g(NO2)/Kg fuel, is about three times greater for hydrogen than for JP at simulated cruise conditions. However, if these results are applied to aircraft designed for a given mission, hydrogen's higher heating value enables the aircraft to have a lower gross weight and a lower fuel flow rate so that the NOx emission rate, Kg (NO2)/hr may be reduced about 30 percent compared to JP. Theoretical kinetics calculations indicate that combustors may be designed for hydrogen that could further decrease NOx emissions by taking advantage of hydrogen's wide flammable limits and high burning velocity. Author

N73-27805*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THERMODYNAMIC AND TRANSPORT PROPERTIES OF GASEOUS TETRAFLUOROMETHANE IN CHEMICAL EQUILIBRIUM
James L. Hunt and Lillian R. Boney Washington Aug. 1973 107 p refs
(NASA-TN-D-7181; L-8483) Avail: NTIS HC $3.00 CSCL 20M

Equations and in computer code are presented for the thermodynamic and transport properties of gaseous, undissociated tetrafluoromethane (CF4) in chemical equilibrium. The computer code calculates the thermodynamic and transport properties of CF4 when given any two of five thermodynamic variables (entropy, temperature, volume, pressure, and enthalpy). Equilibrium thermodynamic and transport property data are tabulated and pressure-enthalpy diagrams are presented. Author

N73-27806*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HEAT TRANSFER CHARACTERISTICS OF A SINGLE CIRCULAR AIR JET IMPINGING ON A CONCAVE HEMISPHERICAL SHELL
John N. B. Livingood and James W. Gauntner Washington Aug. 1973 16 p refs
(NASA-TM-X-2859; E-7462) Avail: NTIS HC $3.00 CSCL 20M

An experimental study was made of the local and average heat-transfer characteristics of a single turbulent air jet impinging on the concave surface of a hemisphere. Correlations were developed for expressing the effects of a number of dimensionless variables on the local and average Nusselt numbers. Results of the present study are compared with those from a similar study concerning a concave surface of a semicylindrical shell. Author

N73-27807*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HANDBOOK OF INFRARED RADIATION FROM COMBUSTION GASES
C. B. Ludwig, W. Malkmus, J. E. Reardon, J. A. L. Thomson, and R. Goulard, ed. 1973 497 p refs
(NASA-SP-3080) Avail: NTIS HC $6.00 CSCL 20M

The treatment of radiant emission and absorption by combustion gases are discussed. Typical applications include: (1) rocket combustion chambers and exhausts, (2) turbojet engines and exhausts, and (3) industrial furnaces. Some mention is made of radiant heat transfer problems in planetary atmospheres, in stellar atmospheres, and in reentry plasmas. Particular consideration is given to the temperature range from 500K to 3000K and the pressure range from 0.001 atmosphere to 30 atmospheres. Strong emphasis is given to the combustion products of hydrocarbon fuels with oxygen, specifically to carbon dioxide, water vapor, and carbon monoxide. In addition, species such as HF, HC1, CN, OH, and NO are treated. Author

N73-27808*# Kentucky Univ., Lexington.
EXTENDED HYDRODYNAMIC THEORY OF THE PEAK AND MINIMUM POOL BOILING HEAT FLUXES
John H. Linehard and Vijay Dhir Washington NASA Jul. 1973 195 p refs
(Grant NGL-18-001-035)
(NASA-CR-2270) Avail: NTIS HC $3.00 CSCL 20M

The hydrodynamic theory of the extreme pool boiling heat fluxes is expanded to embrace a variety of problems that have not previously been analyzed. These problems include the prediction of the peak heat flux on a variety of finite heaters, the influence of viscosity on the Taylor and Helmoltz instability mechanisms with application to film boiling and to the peak heat flux in viscous liquids, the formalization of the analogy between high-current-density electrolysis and boiling, and the description of boiling in the low-gravity limit. The predictions are verified with a large number of new data. Author

N73-27809*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
FIELD REPAIR OF COATED COLUMBIUM THERMAL PROTECTION SYSTEM (TPS) Final Report, Jun. 1970 - Oct. 1972
John D. Culp 15 Sep. 1972 204 p refs
(Contract NAS8-26121)
(NASA-CR-124295; MDC-E0681) Avail: NTIS HC$12.25 CSCL 11C

The requirements for field repair of coated columbian panels were studied, and the probable cause of damage were identified. The following types of repair methods were developed, and are

ready for use on an operational system: replacement of fused slurrey silicide coating by a short processing cycle using a focused radiant spot heater; repair of the coating by a glassy matrix ceramic composition which is painted or sprayed over the defective area; and repair of the protective coating by plasma spraying molybdenum disilicide over the damaged area employing portable equipment. Author

N73-27810# Stuttgart Univ. (West Germany). Inst. fuer Kernenergetik.
FEASIBILITY STUDY AND DEVELOPMENT OF A CONSTANT TEMPERATURE HEAT PIPE SYSTEM. PHASE 1: FEASIBILITY STUDY Final Report
Nov. 1972 135 p refs
(Contract ESTEC-1703-72-SK)
(ESRO-CR(P)-246) Avail: NTIS HC $8.75

An active feedback controlled variable conductance heat pipe system was investigated. Results of a literature survey on heat pipes provides a critical evaluation of their advantages and disadvantages for further space applications. Suggestions for further heat pipe research and development work are given. General comments on design aspects of high performance variable conductance heat pipe systems were studied and a survey on known control mechanisms is presented. Two potential high performance heat pipe concepts are described and their heat transfer capacity is predicted. Theoretical models for predicting steady state and transient behavior, and required auxiliary were derived. Special care was taken to see that the specified setpoint variation was covered by the models. In addition, the steady state behavior of the system in a passive mode of operation is predicted. The analyses performed reveal the design of the system: ammonia as heat carrier, stainless steel as wall and capillary material, argon or helium as control gas. The required volume ratio condenser-to-storage is in the range of 10 - 12.
Author (ESRO)

N73-27811# Cranfield Inst. of Technology (England).
MIXING AND IGNITION OF ENCLOSED SUPERSONIC DIFFUSION FLAMES Final Report, Jul. 1970 - Jul. 1972
Roy A. Cookson Wright-Patterson AFB, Ohio ARL Apr. 1973 41 p refs
(Contract F61052-70-C-0025; AF Proj. 7065)
(AD-760804; ARL-73-0070) Avail: NTIS CSCL 21/2

An experimental study has been made of the effect of combustor geometry on the ignition and combustion of enclosed supersonic diffusion flames. A short film was made of a hydrogen supersonic diffusion flame within a quartz combustor, which indicated that the heat release was uniform and shock free, but that an unusual shock formation was produced just before choking occurred. Kerosene and methane were ignited in an air-flow of Mach number = 2, stagnation temperature approximately 1950K and static pressure 14.7 p.s.i.a., conditions in which autoignition would not normally occur by adding a very small amount of hydrogen to the flow. The amount of hydrogen necessary to produce autoignition of the hydrogen fuels decreases with increasing pressure ratio. The ratio of the amount of hydrogen necessary to produce ignition, to the amount of hydrocarbon fuel was given. It is proposed that the flow disturbance created by radial injection of fuel is similar to that produced by a solid body in the flow. (Author Modified Abstract) GRA

N73-27812# General American Transportation Corp., Niles, Ill. Research Div.
HIGH ALTITUDE BLAST GENERATION SYSTEM: DETONABLE GAS MIXING EXPERIMENTS Final Technical Report
S. F. Fields Aberdeen Proving Ground, Md. BRL Mar. 1973 100 p refs
(Contract DAAB05-72-C-0189)
(AD-760600; BRL-CR-95; AMC-16-73T) Avail: NTIS CSCL 19/4

The overall objective of this program was to investigate experimentally the mixing processes occurring in in-flight balloons of the bar-bell or ballonet type in which initially separate gases (methane and oxygen) are allowed to mix to form a detonable gas mixture during ascent to cruise or test altitude. This investigation has been carried out by testing appropriately scaled model balloons in the Ballistic Research Laboratories: Blast Sphere Facility. During two weeks of tests in the Blast Sphere, a range of simulated altitudes from sea level to 50,000 feet. In addition, a series of seven balloon detonations was performed at a simulated altitude of approximately 35,000 feet. (Author Modified Abstract) GRA

N73-27813# Brigham Young Univ., Provo, Utah. Dept. of Chemical Engineering.
RESEARCH ON NONSTEADY COMBUSTION AND EXTINGUISHMENT Interim Report
Ralph P. Coates and M. Duane Horton Apr. 1973 76 p refs
(Contract AFOSR-1895-70; AF Proj. 9711)
(AD-760788; AFOSR-73-0908TR) Avail: NTIS CSCL 21/9

Experimental and theoretical studies were carried out on acoustic instability during combustion of solid propellants. Experimental tests were made with a conventional T-Burner and with a Quarter-Wave Burner. Special configurations of the T-Burner were used to provide information relative to the dissipation or amplification of acoustic energy by the mean flow field. Measurements were made of the rate of growth of acoustic pressure amplitudes and high speed photographs were taken of the burner plume. These tests indicate that mean flow from burning surfaces parallel to the acoustic field produce a stabilizing effect. Conventional T-Burner data for five different propellant formulations are reported. (Author Modified Abstract) GRA

N73-27826* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HEAT PIPE FLIGHT EXPERIMENTS
Stanford Ollendorf *In its* Significant Accomplishments in Technol., 1972 1973 p 37-41 (For availability see N73-27816 18-34) CSCL 20M

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N73-27814 Pittsburgh Univ., Pa.
NASA AND THE AEROSPACE INDUSTRY: A STUDY OF FEDERAL INFLUENCES ON INDUSTRIAL LOCATION Ph.D. Thesis
David Albert Smith 1972 138 p
Avail: Univ. Microfilms Order No. 73-4986

This dissertation examines the pattern of federal expenditures to the aerospace industry as a case study of the influence of government as a factor of industrial location. The objective is to determine the factors that explain the spatial distribution of NASA expenditures to the aerospace industry. Dissert. Abstr.

N73-27815# Defence Research Analysis Establishment, Ottawa (Ontario).
THE DEFENCE PROGRAM AND NATIONAL INDUSTRIAL DEVELOPMENT (A BACKGROUND PAPER FOR DEFENCE PLANNERS)
C. F. W. Pound Apr. 1973 65 p refs
(DRAE-34) Avail: NTIS HC $5.25

A number of the environmental factors which influence industrial growth in Canada are explored. These include the dominance of the United States in defense technology, uneven rates of economic growth, and the influence of multinational firms in Canadian industry. Canadian factors include the environment for technological innovation, attitudes of Canadians, the government procurement process, and the conflicts which arise between policies for industrial expansion and those for the elimination of regional economic disparities. Author

N73-27816*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SIGNIFICANT ACCOMPLISHMENTS IN TECHNOLOGY, 1972
Washington 1973 186 p refs Symp. held at Greenbelt, Md., 7-8 Nov. 1972
(NASA-SP-326; LC-73-600090) Avail: NTIS HC $3.00 CSCL

228

Space applications research and technology centered reported at this conference centered on spacecraft guidance and control, sensor technology, ground operations, and communications and navigation systems. For individual titles, see N73-27817 through N73-27864.

N73-27817* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE OSO-7 MISSION **c31**
John M. Thole *In its* Significant Accomplishments in Technol., 1972 1973 p 7-10 (For availability see N73-27816 18-34)
CSCL 22B

Addition of a gyro and star sensor to the wheel section of OSO-G provided nighttime pointing capability and functional redundancy in correcting an anomaly that put the combined OSO spacecraft and launch vehicle into a flat spin. G.G.

N73-27818* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DELTA VEHICLE IMPROVEMENTS **c31**
Robert J. Goss *In its* Significant Accomplishments in Technol., 1972 1973 p 11-13 (For availability see N73-27816 18-34)
CSCL 22B

Delta vehicle performance increases associated with 14 major configuration changes are outlined in terms of spacecraft weight into synchronous transfer orbit. Also discussed is the per-mission cost history, except range cost and amortization of development. G.G.

N73-27819* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DELTA LAUNCH VEHICLE INERTIAL GUIDANCE SYSTEM (DIGS) **c21**
Kenneth I. Duck *In its* Significant Accomplishments in Technol. 1973 p 14-15 (For availability see N73-27816 18-34)
CSCL 17G

The Delta inertial guidance system, part of the Delta launch vehicle improvement effort, has been flown on three launches and was found to perform as expected for a variety of mission profiles and vehicle configurations. Author

N73-27820* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STRAP 4 SOUNDING ROCKET ATTITUDE CONTROL SYSTEM **c21**
David J. Shrewsberry *In its* Significant Accomplishments in Technol., 1972 1973 p 16-19 (For availability see N73-27816 18-34)
CSCL 17G

A sounding rocket attitude control system is reported that uses rate integrated gyros operating in both closed loop and open loop modes at very low drift rates. In normal operation the gyros are zeroed on a nearby star and torqued to the proper location in the closed loop mode; rate output is electronically integrated to provide a position displacement signal. Once closed loop torquing is completed, the caging loop is opened and the gyro is operated as angular displacement sensor to provide limit cycle control while viewing the target. G.G.

N73-27821* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INERTIAL REFERENCE UNIT **c21**
Frederick J. Kull *In its* Significant Accomplishments in Technol., 1972 1973 p 20-21 (For availability see N73-27816 18-34)
CSCL 17G

The inertial reference unit is a high performance gyro attitude reference system for use on the OAO spacecraft. The IRU is a three axis system, which provides both rate and attitude information for spacecraft control. The purpose of the IRU is to reduce the dependency on gimballed startrackers and, in turn, simplify the OAO ground operations by eliminating the need for the continual programming of gimballed startracker assignments in accordance with computed occultation schedules. During normal operations, it is used to control the pitch and yaw axes during experiment occultations and during spacecraft reorientations. The roll axis is continuously under control of the IRU except during brief periods for attitude update. To provide for these capabilities the IRU must be able to perform two basic functions. One is to maintain an inertially fixed reference for spacecraft control and the second is to accurately reorient the reference upon command. Author

N73-27822* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FINE POINTING CONTROL, OAO-3 **c21**
James V. Moore *In its* Significant Accomplishments in Technol., 1972 1973 p 22-24 (For availability see N73-27816 18-34)
CSCL 17G

The fine error sensor located within the Princeton Experiment Package (PEP) is designed to aquire a star within its field of view to hold the spacecraft within plus or minus one-tenth of an arc second in pitch, and plus or minus three-arc seconds about the yaw axis. Pointing accuracy and stability tests of the fine error sensor exceeded the plus or minus 0.1 arc second requirement. G.G.

N73-27823* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE DATA PROCESSOR FROM THE SMALL SCIENTIFIC SATELLITE **c08**
Harry G. McCain *In its* Significant Accomplishments in Technol., 1972 1973 p 25-27 (For availability see N73-27816 18-34)
CSCL 09B

A reprogrammable data system aboard a small scientific satellite is described that samples and processes magnetospheric measurements for transmission to the ground. The lightweight configuration of the data system is made up of the program memory, data storage, input/output module, and a central processing unit. The system is designed for multiple missions. G.G.

N73-27824* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE ONBOARD PROCESSOR ON OAO-3 **c08**
Thomas D. Taylor *In its* Significant Accomplishments in Technol., 1972 1973 p 28-31 (For availability see N73-27816 18-34)
CSCL 09B

The onboard data processor for OAO 3 flight applications executes instructions at the rate of 2 1/2 billion per day. The computer commands, processes data, and controls telemetry subsystem programs onboard the spacecraft. G.G.

N73-27825* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GRAVITY-GRADIENT DYNAMICS EXPERIMENTS PERFORMED IN ORBIT UTILIZING THE RADIO ASTRONOMY EXPLORER (RAE-1) SPACECRAFT **c31**
Harvey Walded *In its* Significant Accomplishments in Technol., 1972 1973 p 32-36 (For availability see N73-27816 18-34)
CSCL 22B

Six dynamic experiments were performed in earth orbit utilizing the RAE spacecraft in order to test the accuracy of the mathematical model of RAE dynamics. The spacecraft consisted of four flexible antenna booms, mounted on a rigid cylindrical spacecraft hub at center, for measuring radio emissions from extraterrestrial sources. Attitude control of the gravity stabilized spacecraft was tested by using damper clamping, single lower leading boom operations, and double lower boom operations. Results and conclusions of the in-orbit dynamic experiments proved the accuracy of the analytic techniques used to model RAE dynamical behavior. G.G.

N73-27826* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HEAT PIPE FLIGHT EXPERIMENTS **c33**
Stanford Ollendorf *In its* Significant Accomplishments in Technol., 1972 1973 p 37-41 (For availability see N73-27816 18-34)
CSCL 20M

OAO 3 heat pipe flight experiments to check out weightlessness behavior are reported. Tested were a hollow channel screen system with helical grooves, a heat pipe with a wicking system of horizontal grooves, and a spiral artery pipe with multichannel fluid return to the evaporator. Flight experiment data proved that all heat pipe geometries containing wicking systems provided uninterrupted fluid return to the condensators during weightless-

ness and sufficient cooling for isothermalizing optical instruments onboard OAO. G.G.

N73-27827* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TWO DIMENSIONAL DIGITAL COMPUTER c08
David H. Schaefer *In its* Significant Accomplishments in Technol., 1972 1973 p 42-44 (For availability see N73-27816 18-34)
CSCL 09B

The development of a two dimensional data processing system is reported that extracts data from optical images by performing multiple logical operations simultaneously. A two dimensional logical circuits is described that contains a liquid crystal negation element and an OR-ing element. The negation element performs 20,000 negations simultaneously, and the OR does 20,000 OR operations simultaneously. G.G.

N73-27828* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SECONDARY MIRROR SUPPORT (LST) c31
Edward E. Schmidt *In its* Significant Accomplishments in Technol., 1972 1973 p 45-48 (For availability see N73-27816 18-34)
CSCL 22B

Large structural mirror supports which meet the stiff requirements for launch and orbit operations in particular, dimensionally stable structures made of titanium alloy, can be manufactured with present day technology and at reasonable cost. With continuing research and development in this area, designs of astronomical telescopes and related earth observatory satellites should benefit from this knowledge. Author

N73-27829* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MOMENTUM WHEEL WITH MAGNETIC BEARINGS c15
Leo J. Veillette *In its* Significant Accomplishments in Technol., 1972 1973 p 49-52 refs (For availability see N73-27816 18-34)
CSCL 13I

An engineering model of a momentum wheel is described that is suspended by magnetic bearings. It consists of a mechanical assembly on the right, and associated electronics on the left. The momentum wheel is mounted at the center of the rotor shaft and the magnetic bearings are on each end. The rotor is magnetically suspended so there is no physical contact between the rotor and the support structure. The system, therefore, can operate directly in the vacuum environment without lubrication; and it has virtually unlimited operating lifetime, independent of speed. Author

N73-27830* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN IRONLESS ARMATURE BRUSHLESS TORQUE MOTOR c09
Phillip A. Studer *In its* Significant Accomplishments in Technol., 1972 1973 p 53-55 (For availability see N73-27816 18-34)
CSCL 09A

A high torque motor with improved servo mechanism is reported. Armature windings are cast into an epoxy cylinder and armature conductors are integrally cast with an aluminum mounting ring which provides thermal conductance directly into the structure. This configuration eliminates magnetic hysteresis because there is no relative motion between the rotating magnetic field and any stationary iron. The absence of destabilization forces provides a fast electrical response compared with a typical torquer of conventional construction. G.G.

N73-27831* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MULTISPECTRAL SCANNER (MSS), ERTS-1 c14
Joseph Arlauskas *In its* Significant Accomplishments in Technol., 1972 1973 p 60-62 (For availability see N73-27816 18-34)
CSCL 14B

The multispectral scanner onboard ERTS-A spacecraft provides simultaneous images in three visible bands and one near infrared band. The instrument employs fiber optics to transfer optical images to the detectors and photomultiplier tubes. Detector outputs are digitized and multiplexed for transmission from the spacecraft by analog to digital processor. G.G.

N73-27832* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TWO-INCH RETURN BEAM VIDICON (RBV) MULTISPECTRAL THREE CAMERA SUBSYSTEM c14
Oscar Weinstein *In its* Significant Accomplishments in Technol., 1972 1973 p 63-66 (For availability see N73-27816 18-34)
CSCL 14E

A return beam vidicon multispectral three camera subsystem was developed and built as one of the two principal sensor payloads for the ERTS-A and -B missions. The performance of the cameras on ERTS-1 has been excellent, meeting or exceeding all expectations, especially in the area of geometric fidelity and stability. The three cameras are coaligned in the spacecraft to view the same square ground scene but in different spectral bands. When the separate images are processed and superimposed in their respective colors, they provide a single false color image containing the radiometric and cartographic information required for the ERTS system. The three spectral regions covered by the RBV subsystem are the blue-green red, and the near infrared. The three cameras are exposed simultaneously to facilitate registration of the three separate images into the final color composite. Author

N73-27833* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ERTS WIDEBAND TAPE RECORDER c07
John M. Hayes *In its* Significant Accomplishments in Technol., 1972 1973 p 67-70 (For availability see N73-27816 18-34)
CSCL 14C

The ERTS video bandwith tape recorder uses a rotary head to run the tape in transverse mode; the head wheel gives a head-to-tape surface speed of nearly 5080 centimeter per second. The electronics unit handles 15 megabit per second rate with a bit-error rate of 0.00001. An operational unit onboard ERTS A returned images from the 85 to 90 percent of the earth that are not available in real time. G.G.

N73-27834* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VISIBLE INFRARED SPIN-SCAN RADIOMETER c14
James E. Phenix *In its* Significant Accomplishments in Technol., 1972 1973 p 71-73 (For availability see N73-27816 18-34)
CSCL 14B

The visible infrared spin-scal radiometer (VISSR) may be considered as a camera system capable of simultaneously providing both visible and infrared earth and cloud cover pictures every 20 minutes from the geostationary synchronous meteorological satellite (SMS). With a 0.9-kilometer resolution in the visible spectrum and a 9-kilometer resolution in the IR spectrum, the VISSR/SMS SYSTEM makes its possible to study atmospheric dynamics through 24-hour continuous observation of cloud altitudes, patterns, motion, and temperature distributions. Author

N73-27835* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MULTISPECTRAL IMAGE DISSECTOR CAMERA FLIGHT TEST c14
Bernard L. Johnson *In its* Significant Accomplishments in Technol., 1972 1973 p 74-76 (For availability see N73-27816 18-34)
CSCL 14E

It was demonstrated that the multispectral image dissector camera is able to provide composite pictures of the earth surface from high altitude overflights. An electronic deflection feature was used to inject the gyro error signal into the camera for correction of aircraft motion. G.G.

N73-27836* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VERY HIGH RESOLUTION RADIOMETER c14
Joseph R. Schulman *In its* Significant Accomplishments in Technol., 1972 1973 p 77-81 (For availability see N73-27816 18-34)
CSCL 14B

A very high resolution radiometer is reported that produces visible and infrared images onboard meteorological satellites. The device has a visible and an infrared channel, a resolution in both spectral bands of 0.9260 kilometers from a 1460 kilometer

polar orbit, and scans from horizon to horizon. A two stage radiant cooler with cooled outer housing permits operation in the 100 degrees kelvin range. G.G.

N73-27837* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GSFC COSMIC RADIATION EXPERIMENT FOR THE PIONEER F/G JUPITER MISSION **c31**
James H. Trainor *In its* Significant Accomplishments in Technol., 1972 1973 p 82-85 (For availability see N73-27816 18-34)
CSCL 22B

The extremely lightweight, low power design of the cosmic radiation experiment is obtained by using less than 10 percent of the total weight for the mechanical system. Both the baseplate and the top plate are aluminum honeycomb, the side panels are magnesium trusswork, and the inside circuitry is stacked like a sandwich and interleaved with polyester urethane foam for vibration damping. The flight performance of the experimental hardware is excellent. G.G.

N73-27838* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE INTERNATIONAL ULTRAVIOLET EXPLORER **c31**
Albert Boggess *In its* Significant Accomplishments in Technol., 1972 1973 p 86-88 (For availability see N73-27816 18-34)
CSCL 22B

The International Ultraviolet Explorer is a new astronomical satellite still in the design stage. It is a Delta launched satellite, weighing approximately 365 kilograms, with an intended lifetime of three to five years, and it will serve as a precursor to the large space telescope. The essential features of the satellite are its geosynchronous orbit, a 45-centimeter aperture telescope, and a high performance UV spectrograph using television tubes as detectors. Author

N73-27839* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SCIENCE INSTRUMENTATION PACKAGE, LST **c14**
George Levin *In its* Significant Accomplishments in Technol., 1972 1973 p 89-92 (For availability see N73-27816 18-34)
CSCL 14B

The projected design of an optical instrument package for the large space telescope includes: a diffraction limited camera; low- and high-dispersion spectrographs; astrometric machines; photometers; polarimeters; F/12 camera; Fourier interferometer; infrared instrumentation; and a very high dispersion spectrographs. G.G.

N73-27840* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GLANCING INCIDENCE TELESCOPES FOR SPACE ASTRONOMY **c14**
Jose Alonso, Jr. *In its* Significant Accomplishments in Technol., 1972 1973 p 93-95 (For availability see N73-27816 18-34)
CSCL 20F

A technique for determining the state of polarization of a light source by evaluating its image at the focus of a glancing telescope is reported. An analysis of the central disc of the diffraction image reveals if the light source is polarized, the plane of polarization, and the degree of polarization. When polarized light is incident at the aperture of a diffraction limited glancing telescope, the central disc of the diffraction pattern takes on an elliptical configuration. This ellipticity is caused by the tendency of the electric vector component in the plane of incidence to be absorbed by the reflecting material. As the state of polarization goes from plane polarized to decreasing degrees of elliptically polarized light, the ellipticity of the central disc goes from a maximum at plane polarization to zero at circular polarization. These curves give a direct relationship between the degree of polarization of a light source and the ellipticity of the central disc for this particular telescope, independent of the light source wavelength. Author

N73-27841* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ADAPTIVE GROUND IMPLEMENTED PHASE ARRAY **c07**
Robert E. Spearing *In its* Significant Accomplishments in Technol., 1972 1973 p 103-108 (For availability see N73-27816 18-34)
CSCL 17B

The simulation of an adaptive ground implemented phased array of five antenna elements is reported for a very high frequency system design that is tolerant to the radio frequency interference environment encountered by a tracking data relay satellite. Signals originating from satellites are received by the VHF ring array and both horizontal and vertical polarizations from each of the five elements are multiplexed and transmitted down to ground station. A panel on the transmitting end of the simulation chamber contains up to 10 S-band RFI sources along with the desired signal to simulate the dynamic relationship between user and TDRS. The 10 input channels are summed, and desired and interference signals are separated and corrected until the resultant sum signal-to-interference ratio is maximized. Testing performed with this simulation equipment demonstrates good correlation between predicted and actual results. G.G.

N73-27842* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OPTICAL TRACKING TELESCOPE COMPENSATION **c14**
James W. Gilbart *In its* Significant Accomplishments in Technol., 1972 1973 p 109-112 (For availability see N73-27816 18-34)
CSCL 20F

In order to minimize the effects of parameter variations in the dynamics of an optical tracking telescope, a model referenced parameter adaptive control system is described that - in conjunction with more traditional forms of compensation - achieves a reduction of rms pointing error by more than a factor of six. The adaptive compensation system utilizes open loop compensation, closed loop compensation, and model reference compensation to provide the precise input to force telescope axis velocity to follow the ideal velocity. G.G.

N73-27843* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HIGH EFFICIENCY GROUND DATA TRANSMISSION **c07**
William B. Dickinson *In its* Significant Accomplishments in Technol., 1972 1973 p 113-115 (For availability see N73-27816 18-34)
CSCL 17B

It is demonstrated that state-of-the-art communications technology can be implemented and reliably operated on a global basis to increase the transmission rates and efficiencies on circuits with bandwidths greater than the typical speech channel. Optimization is affected by optimum clock recovery procedures, multilevel pulse amplitude modulation, single sideband amplitude modulation, transversal filter equalizers, data scrambling, and active compensation for phase instability. G.G.

N73-27844* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VERY LONG BASELINE INTERFEROMETRY **c14**
Irving M. Salzberg *In its* Significant Accomplishments in Technol., 1972 1973 p 116-120 (For availability see N73-27816 18-34)
CSCL 14B

S-band stations with dual tracking capability have been used to gather double differential very long baseline interferometry data on Apollo 16 and Apollo 17. This was accomplished by simultaneously receiving both monochromatic radio signal emissions at each of two separated receiving stations, transmitting these data to a central processing facility, and calculating the differences between Doppler angular rates to determine the motion of the lunar roving vehicle. G.G.

N73-27845* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RESULTS OF MARINER MARS TRACKING CALIBRATION EXPERIMENT **c31**
James W. Ryan *In its* Significant Accomplishments in Technol., 1972 1973 p 121-124 (For availability see N73-27816 18-34)
CSCL 22B

Ground station network S-band tracking in three-way Doppler

modes of Mariner 9 in deep space provided geodetic parameters with an accuracy of 15 meters for use in Apollo 16 and Apollo 17 programs. It was concluded that unified S-band Doppler data provide geodetic results with accuracies comparable to laser ranging data. G.G.

N73-27846* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE CALCULATION OF EFFICIENT HIGH PRECISION ORBITS BY OPTIMUM MATCHING OF THE FORMULATION AND NUMERICAL INTEGRATOR c30
Carmelo E. Velez *In its* Significant Accomplishments in Technol., 1972 1973 p 125-128 (For availability see N73-27816 18-34)
CSCL 22C

The development of improved computer algorithms is considered for calculating earth satellite orbital trajectories by optimum selection of the analytical method that minimizes the number of perturbative acceleration computations for a given accuracy. A variation of parameter algorithm considering the equation of motion for a satellite proved superior for the geosynchronous orbit. G.G.

N73-27847* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ERTS ORBIT MAINTENANCE c30
Arthur J. Fuchs *In its* Significant Accomplishments in Technol., 1972 1973 p 129-131 (For availability see N73-27816 18-34)
CSCL 22C

Error drift in the ERTS orbit maintenance problem is determined from the actual ground trace errors that the spacecraft experienced over the first 3 1/2 repeat cycles. Actual data are fitted to a parametric model of ground trace error by a least squares method, and initial offsets to these key parameters as well as their rates of change are extrapolated forward analytically to obtain the future ground trace drift in orbital estimates. G.G.

N73-27848* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ATTITUDE COMPUTATION SYSTEM c14
Roger D. Werking *In its* Significant Accomplishments in Technol., 1972 1973 p 132-135 (For availability see N73-27816 18-34)
CSCL 14B

An attitude computation facility for the control of unmanned satellite missions is reported. The system's major components include: the ability to transfer the attitude data from the control center to the attitude computer at a rate of 2400 bps; an attitude computation center which houses communications, closed circuit TV, graphics devices and a data evaluation area; and the use of interactive graphics devices to schedule jobs and to control program flow. Author

N73-27849* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MISALIGNMENT ESTIMATION SOFTWARE SYSTEM c08
Richard L. DesJardins *In its* Significant Accomplishments in Technol., 1972 1973 p 136-139 (For availability see N73-27816 18-34)
CSCL 09B

A system of computer software, spacecraft, and ground system activity is described that enables spacecraft startrackers and inertial assemblies to be aligned and calibrated from the ground after the spacecraft has achieved orbit. The system generates in the uplink flow an exercise designed to render misalignments visible, and sends the exercise to the spacecraft where the spacecraft inserts the misalignment into the information in the form of attitude sensor error. The information is downlinked for processing into misalignment estimates to be used for correcting spacecraft model at data base. G.G.

N73-27850* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPACECRAFT REORIENTATION VIA SLEWING ABOUT NONORTHOGONAL AXES c21
Paul B. Davenport *In its* Significant Accomplishments in Technol., 1972 1973 p 140-142 (For availability see N73-27816 18-34)
CSCL 17G

A mathematical procedure was developed which determines the exact slews relative to any known axes. The axes may be completely arbitrary; their coordinates merely reside on a data base which can be changed at any time without affecting the software. Given the desired reorientation, the procedure then determines all of the two-legged or three-legged slews which will accomplish the reorientation. For example, there are 12 possible permutations of three axes, and if they are orthogonal each always has two solutions. The nonorthogonal case, on the other hand, gives some surprising results, including the nonexistence of a solution: Consider a large reorientation where the three axes are nearly collinear. In this connection, it can be shown that every three-axis reorientation can be accomplished by three successive slews, if and only if the middle axis is perpendicular to the other two. Author

N73-27851* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPUTER ASSISTED INTERACTIVE RESOURCE SCHEDULING SYSTEM c08
Carl E. Gustafson *In its* Significant Accomplishments in Technol., 1972 1973 p 143-146 (For availability see N73-27816 18-34)
CSCL 09B

A computer system is reported that effectively schedules complex mission support by processing spacecraft requirements, station capabilities, and ephemeris data in teletype format ready for transmission. G.G.

N73-27852* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERACTIVE EXPERIMENTERS' PLANNING PROCEDURES AND MISSION CONTROL c30
Richard L. DesJardins *In its* Significant Accomplishments in Technol., 1972 1973 p 147-154 (For availability see N73-27816 18-34)
CSCL 22A

The computerized mission control and planning system routinely generates a 24-hour schedule in one hour of operator time by including time dimensions into experimental planning procedures. Planning is validated interactively as it is being generated segment by segment in the frame of specific event times. The planner simply points a light pen at the time mark of interest on the time line for entering specific event times into the schedule. G.G.

N73-27853* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ELECTRON BEAM RECORDER IMAGE CORRECTION FOR ERTS c14
Paul Heffner *In its* Significant Accomplishments in Technol., 1972 1973 p 155-158 (For availability see N73-27816 18-34)
CSCL 14B

Video data from the Earth Resources Technology Satellite (ERTS) are entered into the initial image generation system and placed on film using an electron beam to correct for both radiometric and geometric errors, a hardware unit called EBRIC was designed, fabricated, and incorporated in the image processing system. It operates under the control of a process control computer, as it varies video signal and the x and y deflection signals of the EBR. Author

N73-27854* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A PHOTOGRAPHIC PROCESSING CONTROL METHOD FOR ERTS IMAGERY c14
Bernard Peavey *In its* Significant Accomplishments in Technol., 1972 1973 p 159-166 (For availability see N73-27816 18-34)
CSCL 14E

Radiometric accuracy of ERTS photographic image processing is assured by the use of control targets, i.e., sensitometric strips for equipment certification and end-of-roll targets for process verification. These targets are produced by a sensitometer that

is calibrated to cover the performance range parameters. Curve fitting techniques are used to collect performance data accurately, and a feedback procedure indicates malfunctioning. G.G.

N73-27855* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IONOSPHERIC FADING EFFECTS ON THE EQUATORIAL ZONE **c13**
Thomas S. Golden *In its* Significant Accomplishments in Technol., 1972 1973 p 167-170 (For availability see N73-27816 18-34)
CSCL 04A

Microwave fading of space communication channels in the equatorial region is caused by the effects of the disturbed ionosphere. Three dimensional plots of percentage occurrence of very high frequency scintillation effects shown as a function of time of day and week of the year prove that most fading occurs at nighttime and around the weeks of the equinox. The magnitude of fading at the equator violates existing scattering theories and must be taken into account when designing a microwave communication link to space. G.G.

N73-27856* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ATS-5 MILLIMETER WAVE PROPAGATION MEASUREMENTS **c07**
Louis J. Ippolito *In its* Significant Accomplishments in Technol., 1972 1973 p 171-174 (For availability see N73-27816 18-34)
CSCL 20N

Long term experimental measurements to determine the propagation characteristics of 15 and 32 GHz earth-space links and to evaluate performance characteristics of operational millimeter wave systems are reported. The ATS 5 millimeter wave experimental link experienced attenuation and fading characteristics as a function of rainfall rate and other meteorological parameters. A method of site selection for the lowest attenuation rainfall rate improved reception tremendously. G.G.

N73-27857* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COORDINATION PROCEDURE FOR RADIO RELAY AND COMMUNICATION SATELLITE SERVICES **c07**
Jerome Eckerman *In its* Significant Accomplishments in Technol., 1972 1973 p 175-178 (For availability see N73-27816 18-34)
CSCL 17B

A global rain rate statistic model is used to link microwave propagation statistics to measurable rain statistics in order to develop international telecommunication site criteria for radio relay and communication satellite services that minimize interference between receivers and transmitters. This rain coordination procedure utilizes a rain storm cell size, a statistical description of the rainfall rate within the cell valid for most of the earth's surface, approximations between Raleigh scatter and constancy of precipitation with altitude, and an analytic relation between radar reflectivity and rain rate. G.G.

N73-27858* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BALLOON ATMOSPHERIC PROPAGATION EXPERIMENT MEASUREMENTS **c13**
Peter O. Minott *In its* Significant Accomplishments in Technol., 1972 1973 p 179-182 (For availability see N73-27816 18-34)
CSCL 20N

High altitude balloon measurements on laser beam fading during propagation through turbulent atmosphere show that a correlation between fading strength and stellar scintillation magnitudes exists. Graphs for stellar scintillation as a function of receiver aperture are used to predict fading bit error rates for neodymium-yag laser communication system. G.G.

N73-27859* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THEORETICAL AND EXPERIMENTAL COMPARISON OF AN ULTRA-HIGH-SPEED LASER DATA TRANSMISSION SYSTEM **c16**
Mona Tycz *In its* Significant Accomplishments in Technol., 1972 1973 p 183-186 (For availability see N73-27816 18-34)
CSCL 20E

The performance of a digital optical data transmission system is specified by the probability that the system erroneously decides a signal has or has not been transmitted. Two factors which induce signal fading and thereby decrease system performance are atmospheric scintillation and transmitter pointing inaccuracy. A channel simulator was developed that is capable of producing the effects of both atmospheric scintillation and the transmitter pointing problem for a neodymium-yag optical data transmission systems. Comparison of data taken from the modulated intensity of a beam having been transmitted through the channel simulator with experimental data from GEOS-B argon laser transmission through the atmosphere to a low earth-orbiting satellite indicates that the modulated signal intensity is log-normal to the degree of measured atmospheric scintillation. G.G.

N73-27860* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE WAVEGUIDE CO2 LASER **c16**
John J. Degnan, III *In its* Significant Accomplishments in Technol., 1972 1973 p 187-190 (For availability see N73-27816 18-34)
CSCL 20E

A waveguide carbon dioxide laser is reported that is characterized by a very narrow capillary which contains the laser mix. The small capillary allows the device to be operated at pressures as high as 500 torr; pressure broadening of the molecular line is used for tuning. The capillary is placed between two reflectors which provide feedback for the laser oscillation. G.G.

N73-27861* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE CO2 LASER FREQUENCY STABILITY MEASUREMENTS **c16**
Edward H. Johnson, Jr. *In its* Significant Accomplishments in Technol., 1972 1973 p 191-194 (For availability see N73-27816 18-34)
CSCL 20E

Carbon dioxide laser frequency stability data are considered for a receiver design that relates to maximum Doppler frequency and its rate of change. Results show that an adequate margin exists in terms of data acquisition, Doppler tracking, and bit error rate as they relate to laser stability and transmitter power. G.G.

N73-27862* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VOICE INTELLIGIBILITY IN SATELLITE MOBILE COMMUNICATIONS **c07**
Sheldon Wishna *In its* Significant Accomplishments in Technol., 1972 1973 p 195-198 (For availability see N73-27816 18-34)
CSCL 17B

An amplitude control technique is reported that equalizes low level phonemes in a satellite narrow band FM voice communication system over channels having low carrier to noise ratios. This method presents at the transmitter equal amplitude phonemes so that the low level phonemes, when they are transmitted over the noisey channel, are above the noise and contribute to output intelligibility. The amplitude control technique provides also for squelching of noise when speech is not being transmitted. G.G.

N73-27863* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A ZERO-ERROR OPERATIONAL VIDEO DATA COMPRESSION SYSTEM **c07**
Richard L. Kutz *In its* Significant Accomplishments in Technol., 1972 1973 p 199-204 (For availability see N73-27816 18-34)
CSCL 05B

A data compression system has been operating since February 1972, using ATS spin-scan cloud cover data. With the launch of ITOS 3 in October 1972, this data compression system has become the only source of near-realtime very high resolution

radiometer image data at the data processing facility. The VHRR image data are compressed and transmitted over a 50 kilobit per second wideband ground link. The goal of the data compression experiment was to send data quantized to six bits at twice the rate possible when no compression is used, while maintaining zero error between the transmitted and reconstructed data. All objectives of the data compression experiment were met, and thus a capability of doubling the data throughput of the system has been achieved. Author

N73-27864* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HEALTH/EDUCATION TELECOMMUNICATIONS EXPERIMENT c07
Albert A. Whalen *In its* Significant Accomplishments in Technol., 1972 1973 p 204-207 (For availability see N73-27816 18-34)
CSCL 17B

The use of ATS 6 spacecraft in a general telecommunication link for the health/education experiment demonstrates the feasibility of the small receiver-only terminal consisting of a ten foot diameter antenna located on a three-legged mount. The terminal is capable of 0 to 70 degrees elevation, course adjustment, and a plus or minus 5 degree elevation vernier adjustment. Its tuned radio frequency receiver utilizes a cavity back dipole feed and a preamplifier. The indoor unit provides further RF gain and drives a wideband limiter-discriminator. G.G.

N73-27865# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON EASTERN EUROPE - SCIENTIFIC AFFAIRS, NO. 327
13 Jun. 1973 26 p Transl. into ENGLISH of Eastern Europe reports
(JPRS-59273) Avail: NTIS HC $3.50

Articles are presented concerning the development of and progress in the various theoretical and applied scientific disciplines and technical fields in Europe. Data cover the administration, structure, personnel, and research plans of leading East European scientific organizations and institutions, particularly the academies of sciences. Author

N73-27866*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE RESTORATION OF OBLITERATED STAMPED SERIAL NUMBERS BY ULTRASONICALLY INDUCED CAVITATION IN WATER
Stanley G. Young 1973 22 p refs Proposed for presentation at 29th Semiann. Seminar on the Calif. Assoc. of Criminalists, Palo Alto, Calif., 17-19 Oct. 1973
(NASA-TM-X-68257; E-7534) Avail: NTIS HC $3.25 CSCL 20D

Seventeen out of 21 obliterated stamped serial numbers on test specimens of copper, brass, steel, and aluminum were successfully restored. Cavitation induced in water by a piezoelectric transducer was the mechanism used. Primarily, smeared metal was removed from the number grooves by the force of the cavitation, however, numbers were also restored at depths at or below the level of the stamped grooves. The feasibility of this technique as a low cost tool for crime laboratories has been clearly demonstrated. The technique is applicable to a variety of materials, and no previous surface or chemical treatments are necessary. Author

N73-27867# Rhode Island Univ., Narragansett. Pell Marine Science Library.
SEA GRANT PUBLICATIONS INDEX, 1968 - 1971, VOLUME 2
Parmula K. Weedman, comp., Shirley Scott, comp., and Ralph E. Bunker, comp. Rockville, Md. NOAA Sep. 1972 190 p refs
(Contract NOAA-2-35473)
(NOAA-TM-EDS-ESIC-5) Avail: NTIS HC $11.50 CSCL 05B

A KWIC index covering sea life and various other oceanographic research data and phonomena from 1968 through 1971 is presented. E.H.W.

N73-27868*# National Aeronautics and Space Administration, Washington, D.C.
SPACE ACT SIGNED 15 YEARS AGO
Miles Waggoner 29 Jul. 1973 24 p
(NASA-News-Release-73-134) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 05D

A brief history of NASA is presented. Summaries of major programs presented include: manned space flight, space sciences, applications, and technology utilization. F.O.S.

N73-27869# Battelle Columbus Labs., Ohio.
A PROGRAM DEFINITION STUDY FOR THE IMPROVEMENT OF SHORT-HAUL AIR TRANSPORTATION. VOLUME 2: WORKING PAPERS Final Report
Jan. 1973 527 p refs
(Contract DOT-FA72WA-2820)
(FAA-QS-73-1-Vol-2) Avail: NTIS HC $28.50

A program definition study for the improvement of short haul air transportation is presented. The subjects discussed are: (1) patterns of future short haul demand, (2) airport development requirements, (3) private sector constraints, and (4) local community constraints. The study was performed to provide a background for the formulation of a program plan and to define and extend the understanding of the short haul air transportation development plan. For Volume 1 see ATS 08502. Author

N73-27870# Joint Publications Research Service, Arlington, Va.
DISCUSSION OF ENGINEERING LINGUISTICS
K. B. Bektayev, S. K. Kenesbayev, and R. G. Piotrovskiy 29 Jun. 1973 13 p refs Transl. into ENGLISH from Vopr. Yazykoznaniya (Moscow), no. 2, 1973 p 13-20
(JPRS-59397) Avail: NTIS HC $3.00

The advantages and disadvantages of using electronic computers in linguistics, are discussed. Author

N73-27871*# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
RESEARCH AREAS IN THE SCHOOL OF ELECTRICAL ENGINEERING, 1972 Annual Research Summary
1972 119 p refs
Avail: NTIS HC $8.00 CSCL 05B

Research conducted in the School of Electrical Engineering at Purdue University during 1972 is described. Research covered the general areas of: automatic controls, bioengineering, circuits and systems, communication sciences, computers and automata, electromagnetic fields, energy sources and systems, and solid state devices and materials. A.L.

N73-27872# Committee on Appropriations (U. S. House).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION ACT, 1974
Washington GPO 23 Jul. 1973 5 p refs H.R. 75828 enacted into law by the 93d Congr., 23 Jul. 1973
(Pub-Law-91-556; GPO-99-139) Avail: US Capitol, House Document Room

An Act which authorizes appropriations to the National Aeronautics and Space Administration for research and development, construction of facilities, research program management, and various other purposes is presented. Author

N73-27873*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPACE AGE MANAGEMENT FOR SOCIAL PROBLEMS
Arthur L. Levine Apr. 1973 20 p refs Presented at Ann. Conf., Am. Soc. for Public Admin., Los Angeles, 1973 Submitted for publication
(NASA-TM-X-66296; X-630-73-169) Avail: NTIS HC $3.00 CSCL 05A

Attempts to apply space age management to social problems were plagued with difficulties. Recent experience in the State of Delaware and in New York City, however, indicate new possibilities. Project management as practiced in NASA was applied with promising results in programs dealing with housing and social services. Such applications are feasible, according to recent research, because project management utilizes social and

behavioral approaches, as well as advanced management tools, such as PERT, to achieve results. Author

N73-27874*# North Carolina Science and Technology Research Center, Research Triangle Park.
A REGIONAL TECHNOLOGY TRANSFER PROGRAM Final Report, 1 Nov. 1971 - 31 Oct. 1972
P. J. Chenery 31 Oct. 1972 79 p refs
(Contract NASw-2320)
(NASA-CR-133301) Avail: NTIS HC $6.00 CSCL 05B

The activities of the NC/STRC are reported. The background and organization of the regional dissemination center, and marketing methods are discussed along with the services provided, and available information resources. F.O.S.

N73-27875# National Academy of Sciences - National Research Council, Washington, D.C.
AN APPRAISAL OF HALOGENATED FIRE EXTINGUISHING AGENTS
1972 348 p refs Proc. of Symp. held at Washington, D. C., 11-12 Apr. 1972
(PB-218448/9; ISBN-0-309-02111-1) Avail: NTIS MF $0.95; National Academy of Sciences-PPO 2101 Constitution Avenue, N. W., Washington, D. C. 20418 HC $5.50 CSCL 13L

The report describes current research on practical uses of halogenated fire extinguishing agents by fire fighters and fundamental toxicity research studies designed to identify potential health problems arising from the use of halogenated agents. It consists of two groups of papers--those concerned with the fire-fighting applications of these agents and those concerned with the potential toxicological hazards resulting from the use of these agents. The applications papers present the engineering and fire protection points of view, describing the effectiveness of various Halons. The toxicity papers provide insight on safe circumstances of human exposure and on potential health problems that might be associated with actual exposure during fire control activities. GRA

N73-27876# Madison County Planning Board, Wampsvill, N.Y.
MADISON COUNTY TRANSPORTATION. A SURVEY OF EXISTING TRANSPORTATION FACILITIES, CLASSIFICATION OF THEIR EXISTING USES, CAPACITY AND POTENTIAL FOR FUTURE DEVELOPMENT Final Report
Jul. 1972 73 p Sponsored by HUD
(PB-218453/9) Avail: NTIS HC $5.75 CSCL 13B

In addition to the main emphasis on current highway conditions and limitations on development the report considers the relation between transportation, development pattern, and mass transit facilities and potentials. The historical context is important as the existing highway system was built to satisfy the needs of an evenly distributed agricultural society long since supplanted by an increasingly commuter based economy. Assuming that Madison County development trends continue, there will be dispersed commuter-oriented development that restricts the free flow of traffic at the same time that it increases traffic volumes. GRA

N73-27877# Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
INVESTMENT STRATEGIES FOR DEVELOPING AREAS: MODELS OF TRANSPORT
Richard De Neufville, John Hoffmeister, and David Shpilberg Jan. 1973 93 p refs
(Contract DOT-OS-00096)
(PB-219292/0; DOT-P-5200.7) Avail: NTIS HC $3.00 CSCL 13B

The basic objective of the present study is to support Department of Transportation activities in advising developing countries on transport infrastructure improvements. Models of air, river and highway transportation are developed for use in the comparison of alternative investment strategies in transportation for developing areas. The work performed under this contract was executed simultaneously with a parallel contract DOT-OS-00080). The results, however, are presented here. For a full exposition, both reports would be considered jointly. (Author Modified Abstract) GRA

N73-27878# Transportation Systems Center, Cambridge, Mass.
SUMMARY DATA FOR SELECTED NEW URBAN TRANSPORTATION SYSTEMS Final Report, Aug. 1971 - May 1972
Robert F. Casey Nov. 1972 124 p refs
(PB-219254/0; DOT-TSC-OST-72-35) Avail: NTIS HC $3.00 CSCL 14F

A selected set of information is presented for the most advanced of the new, unconventional or innovative urban transportation systems. Capsulized are system and vehicle physical characteristics, performance capabilities, costs, and availabilities. A functional classification was developed and each system was categorized according to type of service provided. A method for using the data in the development of transportation plans for metropolitan areas is outlined. Author (GRA)

N73-27879# George Washington Univ., Washington, D.C. School of Engineering and Applied Science.
DULLES AIRPORT RAPID TRANSIT STUDY
B. A. Claveloux 1973 271 p refs
(Grant NSF GZ-2605)
(PB-220074/9; ME-251-252-B) Avail: NTIS HC $3.00 CSCL 13B

Various aspects are examined of the feasibility of a high-speed transit service between downtown Washington, D.C. and Dulles Airport. The route selected is one that utilizes, for the most part, existing rights of way, and the calculated velocity schedule provides a 10-minute total travel time. (Author Modified Abstract) GRA

N73-27880# Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
ROLE OF AIR TRANSPORTATION IN SPARSELY DEVELOPED AREAS
Richard DeNeufville, Ulpiano Ayala, Jorge Acevedo, and Luis Mira Jan. 1973 174 p refs
(Contract DOT-OS-00080)
(PB-219293/8; R72-49; DOT-P-6000.1) Avail: NTIS HC $3.00 CSCL 01B

The basic objective of the study, was to support Department of Transportation activities in advising developing countries on transport infrastructure improvements. A theoretical base for evaluating the effect of transport investments in a developing area is presented. A model is developed to estimate the optimal modes of transportation for areas with differing levels of traffic. The model shows that under certain circumstances air transportation has significant cost and service advantages over alternative modes. This guideline is substantited by an extensive case study of the experience of SATENA, a government-operated airline in Colombia. (Author Modified Abstract) GRA

N73-27881# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
ARCTIC ENVIRONMENTAL CONSIDERATIONS
28 Jun. 1972 47 p refs
(AD-761105; TOP-1-1-001) Avail: NTIS CSCL 15/5

The report is intended to assist TECOM agencies and item developers evaluating potential or actual test items by providing basic information on the effects of cold. The information provided is limited to the most common types of material and materiel. GRA

N73-27882# Army Missile Command, Redstone Arsenal, Ala. Aeroballistics Directorate.
CONSTANT GAIN OPTIMAL TRACKING LAWS FOR FINITE FINAL TIME
Richard E. Dickson 24 Apr. 1973 31 p refs
(DA Proj. 1M2-62303-A-214)
(AD-761091; RD-73-10) Avail: NTIS CSCL 15/3

To have constant gain optimal tracking control laws for finite final time, cost must be placed upon the undetermined multiplier at the final time. Analytic examples of tracking with disturbances illustrate the approach. Author (GRA)

N73-27883# Army War Coll., Carlisle Barracks, Pa.
THE NATIONAL GUARD: IS CONUS ARMY AIR DEFENSE A NATURAL? Student Essay

Nathaniel Wicks 24 Aug. 1972 25 p refs
(AD-760483) Avail: NTIS CSCL 15/3

The Army National Guard's operational record during their current assignment to the United States Army Air Defense Task Organization, Ent Air Force Base, Colorado has established an Air Defense mission performance record above reproach. In view of the current economic policy of the present administration the operational responsibility of the remaining active Army NIKE-HERCULES Air Defense sites, as they are presently configured in the United States, should be given to the Army National Guard. The proposed transfer of this mission responsibility to the Army National Guard, as recommended herein, will produce a savings in Department of the Army funds and, most important, will give the North American Air Defense Command and the Continental Air Defense Command an Air Defense force that normally exceeds active Army Air Defense fire units in readiness and performance. Author (GRA)

N73-27884# Informatics, Inc., Rockville, Md.
SELECTED MATERIAL FROM SOVIET TECHNICAL LITERATURE, FEBRUARY 1973
Stuart G. Hibben 11 Apr. 1973 197 p refs
(Contract F44620-72-C-0053; ARPA Order 1622-4)
(AD-759275; AFOSR-73-0642TR) Avail: NTIS CSCL 05/2

The report includes abstracts and bibliographic lists on contractual subjects that were completed in February, 1973. The major topics are: laser technology, effects of strong explosions, geosciences, particle beams, and material sciences. A section on biocybernetics and one on items of miscellaneous interest are included as optional topics. Laser coverage is generally limited to high power effects. All current laser material is routinely entered in the quarterly laser bibliographies. An index identifying source abbreviations and a first-author index to the abstracts are appended. Author (GRA)

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159

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